

# Annals

of the

## Missouri Botanical Garden

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Vol. 38

MAY, 1951

No. 2

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JESSE MORE GREENMAN (\*1867-†1951)

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The many friends of Dr. J. M. Greenman were saddened by his death on January 20, 1951, at the age of eighty-three years.

Jesse More Greenman was born on December 27, 1867, at North East, Erie County, Pennsylvania, the son of James William and Clarissa (More) Greenman. Entering the University of Pennsylvania in 1888, he served successively as assistant (1890-92) and as instructor (1893-94) in botany, graduating in 1893 with the degree of Bachelor of Science. In 1894 he transferred to Harvard University where he was assistant in the Gray Herbarium until 1899, when he was awarded the degree of Master of Science.

It was during these years at the Gray Herbarium that he became associated with the late Benjamin Lincoln Robinson and was a fellow student with the late Merritt Lyndon Fernald. At that time botanists of the United States were only beginning to appreciate fully the rich opportunities in the floristics of tropical America, and particularly of Mexico. Following the example of his illustrious predecessors at the Gray Herbarium, Robinson plunged into the determination of the fascinating collections of Edward Palmer, C. J. Pringle, L. C. Smith, E. W. Nelson, and others. In this he was aided materially by Greenman and to a lesser extent by Fernald (whose real interests already were in the flora of the north-eastern seaboard).

In these years Robinson evidently became a model for the somewhat younger Greenman, both professionally and personally, and the fancied emulation has been apparent to many of the friends and students of both men, amongst whom the writer of this notice is fortunate to be included. Both could be recognized instantly as "gentlemen of the Old School": courtly and immaculate, soft-spoken and deliberate in word and action; innately conservative and studied, perhaps, to most of their younger contemporaries. In the case of Robinson, lightened daily by a characteristic humane warmth and tolerance even in his declining years, the

total effect possibly was more original to those who knew them both. In Greenman, it has long appeared to the writer of this notice that the true man lay somewhat deeper beneath the surface, and was only occasionally evident in delightful flecks of Barriesque humor which his friends will always cherish.

The parallelism of Robinson and Greenman is striking in their professional careers: while Robinson elected the vast genus *Eupatorium* as a life work, Greenman chose the even more appalling genus *Senecio*. Neither lived to complete his task. While Robinson went to the University of Strasbourg to receive his doctorate of philosophy under De Bary, Greenman went as a Kirkland Fellow (1899-1901) to study under Adolf Engler at the University of Berlin, which conferred upon him the Ph.D. in 1901. Returning to Harvard in 1902, he married Anne Louise Turner and resumed his duties as assistant at the Gray Herbarium, having also been appointed instructor in botany (1902-05) at the same time that Fernald received a similar promotion. Greenman's teaching assignment, interestingly, was to conduct a class in plant geography; Fernald, with only his B.S. from Harvard College, was to conduct an elementary class. (Robinson, save for "research instruction," never taught a formal class during his entire career at Harvard!)

In my mind's eye I have long projected a fancied crisis in the little group of botanists at the Gray Herbarium in the year 1905. In that year there developed the possibility for a promotion to assistant professor at Harvard for one of the two younger men; there also came a request from the Field Columbian Museum of Chicago for an applicant for the post of assistant curator of botany under the late Charles F. Millspaugh. I have long taken it as a fitting tribute to the perception and moral strength of Robinson that he chose Fernald to remain with him at Harvard rather than Greenman, with whom he had so much more in common. The decision may have reflected the needs of the forthcoming seventh edition of 'Gray's Manual' (published in 1908), but I am inclined to believe that Robinson saw in Greenman too much of himself for the best interests of the Gray Herbarium. I am sure that the decision was a bitter disappointment to Greenman; but his admiration for Robinson was never dimmed. Both he and Mrs. Greenman long half-expected their eventual return to Cambridge, which they loved so well.

Greenman took up his duties as assistant curator at Chicago in 1905. In 1908, perhaps to offset the defection-from-the-ranks of taxonomy by the late John Merle Coulter, he was appointed assistant professor at the University of Chicago, teaching taxonomy and plant geography. I suspect that working conditions at the Field Museum were none too pleasant for all concerned, and also that the emphasis placed upon morphology and Coulter's later contempt for taxonomy (which seems to continue at that University to this day) were rather discouraging to a young botanist in the tradition of Engler, Robinson, Watson, and Gray. At any rate, when he was invited to join the staff of the Missouri Botanical Garden and the Shaw School of Botany of Washington University in 1913, Greenman was quick to accept. With him to St. Louis came the *Senecios* which were to be his companions until his death.

I believe that the Greenmans discovered in St. Louis at least partial consolation for the loss of Cambridge. At the Missouri Botanical Garden the new director, George T. Moore (an old friend from Harvard days), had gathered together a small group of other former Harvard associates which could compare in brilliance and accomplishment with the botanical staff of their old *alma mater* herself. With its almost unexcelled botanical library, its large herbarium of unplumbed value ("unplumbed" because it was so disorganized!), its new and modern physiological laboratories, its greenhouses, its newly launched ANNALS, and perhaps above all its Lackland Fellowships sagaciously maneuvered by Dr. Moore from his Board of Trustees, the Missouri Botanical Garden and the Shaw School of Botany achieved national, if not international, significance almost over night.

Dr. Greenman became curator of the herbarium of the Missouri Botanical Garden and associate professor of botany at Washington University in 1913; in 1917 he was promoted to full professor at the University. At the Garden, he found an Augean stable in the herbarium. Founded by the purchase of the personal collection of Bernhardt in 1857 and the bequest of that of Engelmänn in 1884, it had been augmented copiously but indiscriminatingly and presided over rather casually in the succeeding years. No detailed inventory of its contents existed. Greenman estimated the total number of specimens at 614,660, and began a painstaking system of accession records. Then began the almost hopeless task of orderly arrangement of this considerable museum, the laborious identification of the extremely valuable historical material from the scrappy bits of evidence accompanying them (particularly in the Bernhardt herbarium), and of course the never-ending struggle to keep abreast of current accessions as well—all virtually single-handed. With his rather stern sense of duty as he saw it, it was inevitable that his own research should be thrust almost out of sight into the background.

There can be little doubt that Greenman's new role as a teacher in the Shaw School of Botany utilized his character and training most advantageously. He was a willing, thorough, and patient teacher. Where, in his day (or in ours?) could one find another prepared (or even interested) to offer courses of graduate level in bryophytes, pteridophytes, gymnosperms, angiosperms, and plant geography? Neither was he averse to undergraduate instruction, and for a number of years conducted the beginning course in botany in addition to his other duties.

Although not an original lecturer, Greenman's gentle courtliness everlastingly endeared him to all his students at Washington University. It was not so much what he said as the way that he said it; a rather pedantic reference to dichotomy could be accompanied by a glance that would warm his hearer with ill-defined pleasure. But at once the most cultivated and gracious of men, he could be the most punctilious and unyielding.

Organizational activities were attractive to Greenman, and he was in frequent attendance at scientific conventions. He was a member of the Botanical Society of America, the Ecological Society of America, the American Society of Naturalists, the New England Botanical Club, the Germanistic Society of St. Louis, the American Association of University Professors, the New York, the Illinois, and

the St. Louis academies of science, and the honorary societies of Phi Beta Kappa, Sigma Xi, and Phi Sigma; he was a corresponding member of the Academy of Natural Sciences of Philadelphia, an honorary chairman of the University of Pennsylvania Bicentennial Committee, a fellow of the American Association for the Advancement of Science (chairman of Section G in 1936-37), and president of the American Society of Plant Taxonomists for 1938. His social clubs included Sigma Alpha Epsilon fraternity, the University and the Harvard clubs of St. Louis, and the Faculty Club of Washington University. He was a Democrat and a nominal Presbyterian.

Although socially gifted and inclined, Dr. Greenman's herbarium, his students, and his Senecios more and more circumscribed his life. Except for short vacations during the lifetime of Mrs. Greenman and for a collecting expedition of three months to Central America with his younger son, Milton T. Greenman, in 1922, all his waking hours seemed to be spent in the big brick building on Tower Grove Avenue. Apparently never a strong man, a series of severe illnesses beginning in 1925 took their toll of him. In 1936 Mrs. Greenman died, leaving him without the care with which she had attended him; but his steely determination carried him on.

In 1945 Dr. Greenman was the victim of a cerebral hemorrhage. Upon his partial recovery he was appointed professor *emeritus* by the University, and in 1948 as curator *emeritus* by the Garden. Now that it was too late, he was given leave to return to his Senecios as he had planned in his youth. Walking daily from his home on Magnolia Avenue to the Garden, he pursued his remaining joy. For one who had suffered for so long, the end was a gentle withdrawal.

The fame of some men rests not so much upon what they have done of themselves as upon what they have done through others. So it is with Jesse More Greenman. It may be said with little dispute that his impress upon American taxonomy, through his students, is second to none in America. The reverence and affection in which they will always hold him is still reflected in the salutation of the *Festschrift*<sup>1</sup> with which they greeted him upon the seventieth anniversary of his birth:

December 27, 1937.

Dear Dr. Greenman:

We, your pupils, have gathered today to greet you and to celebrate your academic festival. To commemorate the day, some of us have brought to the feast table these contributions. Singly, and of themselves, they are not of great significance. They are impressive because of the composite evidence they offer of the degree to which your scholarship has been projected into the second generation and beyond. They are the fruits of your teaching.

A number of years ago, one of us, in talking with your own teacher, Professor Engler, referred to himself as an academic grandchild, much to Engler's interest and amusement. Engler's generation is passed now, and you have become the dean. Your own academic grandchildren are beginning to carry forward into another generation the essence of scholarship which you have given us.

We are deeply grateful for this gift of yours, for with it we have found inspiration to emulate you. And so we come to you now, in the full fruition of your years and labor, seated in the herbarium which your effort and will have created. May these contributions speak of our appreciation, our respect, and our affection; for they recall vividly to us that tolerance and unassailable kindness which guided us . . .

<sup>1</sup> Ann. Mo. Bot. Gard. 25:1-453. 1938.



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## CHROMOSOME NUMBERS OF CALIFORNIAN DELPHINIUMS AND THEIR GEOGRAPHICAL OCCURRENCE<sup>1</sup>

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The genus *Delphinium* is represented in California by about twenty-six species. Several of horticultural interest have been studied by Mehlquist; others have been studied extensively with respect to their interfertility and evolutionary relationships by Lewis and Epling. In the course of these investigations most of the California species of *Delphinium* have been examined cytologically and a summary of our combined observations on chromosome numbers (Table I) and cytological behavior is presented here.

The materials used were either squash preparations of buds fixed in 1:3 acetic alcohol and stained in aceto-orcein or sectioned root tips fixed in CRAF and stained in safranin-gentian violet. These buds and roots were collected in the field or were taken from wild transplants grown in the garden.

### CYTOLOGICAL OBSERVATIONS

The basic haploid chromosome number in the genus *Delphinium* is 8 (Darlington & Janaki-Ammal, 1945). We have found no deviations from this basic number although three of the species examined, *D. variegatum*, *D. bansenii*, and *D. gypsophilum*, have tetraploid races (Table I). The karyotypes of *Delphinium* species are morphologically very similar (Langlet, 1927; Tjebbes, 1927; Lewitsky, 1931; Lawrence, 1936; Gregory, 1941). Each genome has two long chromosomes, four of intermediate length and two quite short ones. The centromeres of the long chromosomes are submedian; those of the remainder, subterminal. The relative lengths at mitotic metaphase of each chromosome and the positions of their centromeres are shown diagrammatically in fig. 1A. This diagram is based upon measurements from root tips of *D. bansenii*, *D. parishii*, *D. hesperium*, *D. variegatum*, *D. parryi*, *D. gypsophilum*, and *D. recurvatum*. Chromosomes *a* and *b* are readily distinguishable during mitosis or meiosis by the relative lengths of their two arms. Chromosomes *c*, *d*, and *f* are difficult to distinguish from each other in mitotic divisions and are indistinguishable in meiosis. Chromosome *e* can usually be recognized in somatic divisions by the presence of a small satellite at the end nearest the centromere but usually can not be told from *c*, *d*, and *f* during meiosis. The two short chromosomes can usually be recognized by their small size but can not always be distinguished from each other.

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<sup>1</sup>This paper represents a report of two largely separate studies, one by Mehlquist and Wyckoff order to provide in one place more complete data than would otherwise have been possible. Mehlquist while at the University of California, and one by Lewis and Epling. The combination was made in Mehlquist and Wyckoff are largely responsible for the mitotic counts on the accessions credited to Mehlquist alone or Mehlquist and others. Lewis and Epling are responsible for the remainder of the cytological data and all systematic determinations.

The tetraploid races of *D. variegatum*, *D. hanseni* and *D. gypsophilum* have indistinguishable karyotypes and differ from the diploids only in the double number.

Meiosis has been studied in pollen mother cells of 45 diploid transplants and 36 tetraploids as follows:

Diploids	Tetraploids
<i>D. gypsophilum</i> (1)	<i>D. gypsophilum</i> (4)
<i>D. hanseni</i> (20)	<i>D. hanseni</i> (22)
<i>D. hesperium</i> (4)	<i>D. variegatum</i> (10)
<i>D. inopinum</i> (3)	
<i>D. parishii</i> (1)	
<i>D. parryi</i> (6)	
<i>D. recurvatum</i> (3)	
<i>D. umbraculorum</i> (3)	
<i>D. variegatum</i> (4)	

TABLE I

	2n chromosome number	Number of populations	Number of plants
<i>D. andersoni</i> Gray	16	3	8
<i>D. californicum</i> T. & G.	16	2	10
* <i>D. cardinale</i> Hook.	16	6	26
<i>D. decorum</i> Fisch. & Mey. ssp. <i>Tracyi</i> Ewan	16	2	8
<i>D. glaucum</i> Wats.	16	1	6
<i>D. gracilentum</i> Greene	16	1	1
<i>D. gypsophilum</i> Ewan	{ 16 32 16 32	{ 16 19 66 16	{ 156 222 437 143
<i>D. hanseni</i> Greene	16	11	30
<i>D. hesperium</i> Gray	16	14	71
<i>D. hesperium</i> f. <i>pallidum</i> Ewan	16	1	9
<i>D. hesperium</i> var. <i>cuyamaca</i> (Abrams) Jeps.	16	3	6
<i>D. inopinum</i>	16	7	26
† <i>D. nudicaule</i> T. & G.	16	1	5
<i>D. nuttallianum</i> Pritz.	16	25	65
<i>D. parishii</i> Gray	16	32	104
<i>D. parryi</i> Gray	16	11	21
<i>D. parryi</i> ssp. <i>seditionum</i> (Jeps.) Ewan	16	4	24
<i>D. parryi</i> var. <i>blochmanae</i> (Greene) Jeps.	16	11	29
<i>D. patens</i> Benth.	16	1	1
<i>D. polycladon</i> Eastw.	16	3	9
<i>D. purpusii</i> Brandg.	16	3	17
<i>D. recurvatum</i> Greene	16	5	10
<i>D. troilifolium</i> Gray	16	1	10
<i>D. uliginosum</i> Curran	16	8	22
<i>D. umbraculorum</i>	{ 16 32	{ 22 6	{ 99 28
<i>D. variegatum</i> T. & G.			
		Tot. 301	Tot. 1603

\*Previously reported by Mehlquist et al. (1943).

†Previously reported by Gregory (1941).



Fig. 1. A, diagram of the relative lengths of mitotic metaphase chromosomes representative of a species complex referred to in the text. B, representative meiotic metaphase I of a diploid (*D. parishii*). C, anaphase I of a diploid showing a bridge and fragment (f). The bridge involves chromosomes *a* or *b* (*D. parryi*). D, anaphase I of a tetraploid showing delayed separation of chromosomes *a* or *b* (*D. gypsophilum*). E, representative metaphase I of a tetraploid showing 12 bivalents, 1 quadrivalent ring, and 1 quadrivalent chain (*D. variegatum*).



Chiasma frequencies observed at diplotene are nearly constant for all the species examined and agree with those previously reported for *D. cardinale* (Mehlquist et al., 1943). The longest chromosome, *a*, has a chiasma frequency close to 1.0 for each arm. However, a chiasma in only one arm is sometimes found and a second chiasma may occasionally occur in one or both arms. More than two chiasmata per arm have not been observed. Chromosome *b* has a chiasma frequency close to 1.0 in the longer arm; one is usually present in the shorter arm but its precise frequency has not been determined. Chromosomes *c*, *d*, *e*, *f*, *g* and *h* generally have but one chiasma per bivalent, which is in the long arm, although an additional chiasma may rarely occur in the short arm.

Eight bivalents occur regularly in the diploids at metaphase I, but quadrivalents are frequent in the tetraploids. In 418 tetraploid cells, 183 (44 per cent) had 1 quadrivalent, 144 (34 per cent) had two quadrivalents, and no cells had more than two. The quadrivalents were confined to the two long chromosomes *a* and *b*, the former being quadrivalent in 70 per cent of the cells examined and the latter in 44.5 per cent. Of the possible quadrivalent types (Darlington, 1937) only a simple ring of four or a chain of four has been found (fig. 1E).

Disjunction of the quadrivalents at anaphase may result in either adjacent or alternate chromosome separation (fig. 1E). However, configurations indicating alternate separation are about twice as numerous as those indicating adjacent separation. Either type of separation produces nearly 100 per cent visibly good pollen and the plants concerned are fully fertile. Trivalents have rarely been observed between any of the chromosomes.

The shortest chromosomes frequently separate precociously and can often be seen as univalents at diakinesis, indicating either that no chiasmata were formed or that terminalization and separation occurred during prophase. Segregation of these chromosomes is usually equal, although it is occasionally 3 and 1 in the tetraploids. Diploid gametes carrying an extra short chromosome can function, for at least one plant grown in the greenhouse had an extra *b* chromosome. Unequal segregation of this pair in diploids apparently results in non-functional gametes.

Terminalization of chiasmata is usually complete in the six shorter pairs at metaphase I but is often incomplete in one or both arms of chromosomes *a* and *b* (fig. 1B). Sometimes separation of these chromosomes is greatly delayed at anaphase I in both diploids and tetraploids (fig. 1D). In this case the unseparated ends of the chromosomes remain on the equator until after the centromeres have reached their respective poles. The chromosomes are stretched thin and are obviously under tension, but there is no evidence in subsequent stages that breakage or abnormal separation occurs. It has been shown on a number of occasions that terminalization of chiasmata is arrested by changes in homology (Sansome, 1932; Catcheside, 1932; Darlington, 1937) and, further, that such an arrest need not lead to breakage of chromatids (Darlington, 1931). Stretched chromosomes showing delayed separation have recently been found by Marta Walters (1950) in the hybrid *Bromus trinii* × *B. maritimus* where she has suggested that the delayed

separations may be due to changes in homology of the chromosomes. In the present instance the anaphase stretching may result from the formation of chiasmata in inversion heterozygotes, but proximal to the inversions. This is further suggested by the fact that the delayed separations are often observed in the same plants that show inversion bridges.

Pachytene has been difficult to study in our preparations. Our observations on the occurrence of inversions is accordingly based upon the anaphase. Bearing this in mind, it would seem that most of the inversion bridges apparently involve the longer chromosomes, but it has not been possible to determine either the number of inversions or the particular chromosomes in which they occur.

Anaphase bridges characteristic of those produced by crossing over within an inversion were found in 10 (22 per cent) of the diploids examined and 25 (70 per cent) of the tetraploids. In many instances the accompanying fragment was clearly visible (fig. 1C); in others it may have been obscured by other chromosomes. It is probable that inversions were present in more plants than is indicated inasmuch as bridges in plants where they did occur were seen in only 0.8–1.7 per cent of the anaphase and telophase cells examined. The possibility of inversions passing unnoticed if a limited number of cells can be examined is, therefore, very great.

In view of the high frequency of inversion heterozygotes found in them the tetraploids may carry still other inversions than those of their corresponding diploids. However, even if the diploids and tetraploids do not differ in the particular inversions which they carry, the chances of a tetraploid with 4 homologous chromosomes being heterozygous for any given inversion is materially increased.

More than one bridge has not been observed in the same cell, which might suggest that but a single inversion is involved in all of the plants. However, the frequency of bridges is so low that the chances of observing two bridges in a single cell from crossing over in two inversions would be very small indeed.

All of the species in which inversion bridges have been found are interfertile to some extent, and several of them grow in close proximity to one another or even together. The inversion heterozygotes referred to may therefore be the result of interspecific hybridization.

#### GEOGRAPHICAL DISTRIBUTION

The geographical distribution of the colonies in which chromosome counts were made, including their precise locations, are indicated in the following list, together with label data which will identify the vouchers on file in the herbarium of the University of California, Los Angeles. The number of plants at each locality of which the chromosome number was determined is shown in parentheses. In some cases two collections from the same colony are combined. The species concerned are listed alphabetically.

## DELPHINIUM ANDERSONI Gray (2n = 16)

LASSEN CO.: 3.3 mi. n. of Ravendale, *Meblquist & Jenkins* 380 (3).

MODOC CO.: west cinder-slope of Sconchin Butte, Lava Beds Nat'l. Mon., *Meblquist & Jenkins* 377 (3); n. base of Caldwell Butte, Lava Beds Nat'l. Mon., *Meblquist & Jenkins* 378 (2).

## DELPHINIUM CALIFORNICUM T. &amp; G. (2n = 16)

CONTRA COSTA CO.: near Juniper Camp, Mt. Diablo, *Meblquist & Compton* 305 (5).

MONTEREY CO.: near Aromas, *Meblquist* 300 (5).

## DELPHINIUM CARDINALE Hook. (2n = 16)

LOS ANGELES CO.: Sepulveda Canyon, Santa Monica Mts., *Meblquist & Compton* 301 (6); San Antonio Wash near Claremont, *Meblquist & Compton* 296 (5).

SAN BERNARDINO CO.: 2 mi. e. of Upland on Highland Ave., *Meblquist* 396 (11).

SAN DIEGO CO.: near Banner, *Meblquist & Geissman* 404 (4).

SANTA BARBARA CO.: near Lompoc, *Meblquist* 20 (5); 3 mi. s. of Lompoc on the Santa Rosa Rd., *Meblquist* 295 (yellow-flowered) (5).

## DELPHINIUM DECORUM Fisch. &amp; Mey. subsp. TRACYI Ewan (2n = 16)

HUMBOLDT CO.: 2 mi. s. of Kneeland on the rd. to Bridgeville, *Meblquist & Jenkins* 368 (4); South Fork of Van Duzen R., *Meblquist & Jenkins* 374 (4).

## DELPHINIUM GLAUCUM Wats. (2n = 16)

SAN BERNARDINO CO.: Dobb's Cabin, San Bernardino Mts., *Meblquist & Compton* 302 (6).

## DELPHINIUM GRACILENTUM Greene (2n = 16)

BUTTE CO.: 2.5 mi. n. of Little Butte Creek bridge on the Paradise to De Sabla Rd., May 25, 1941, *Lewis & Epling* (1).

DELPHINIUM GYPSOPHILUM Ewan, *Diploid* (2n = 16) (Fig. 2)

KERN CO.: 1 mi. s. w. of Poso Creek on the Bakersfield to Woody Rd., April 14, 1944, *Lewis & Epling* (15); U. S. Hwy. 466, 4.2 mi. n. of the w. rd. to Caliente, April 22, 1943, *Lewis & Epling* (15); 1.5 mi. n. of McKittrick on Hwy. 33, *Meblquist* 411, April 23, 1943, *Lewis & Epling* (19); 5.0 mi. s. w. of Maricopa on U. S. Hwy. 399, *Lewis & Epling* 531, *Epling & Miles* 545 (47).

MONTEREY CO.: 2.4 mi. w. of the jtn. at Pleyto, *Lewis & Epling* 697 (1); 3.0 mi. w. of the jtn. at Pleyto, *Lewis & Epling* 657, 699 (1); 4 mi. w. of the jtn. at Pleyto, *Lewis & Epling* 698 (8); 6.2 mi. e. of King City on the rd. to Hollister, *Lewis & Meblquist* 431 (1); Bradley to Jolon rd. at jtn. with rd. to Pleyto, *Lewis & Epling* 694, 782 (9).

SAN BENITO CO.: 0.8 mi. w. of Bitterwater, *Lewis & Epling* 820 (1).

SAN LUIS OBISPO CO.: 2.9 mi. w. of U. S. Hwy. 101 on rd. to Cambria from Templeton, *Lewis & Epling* 664 (4); 1.5 mi. s. of Klau, *Lewis & Epling* 661, 689 (13); 0.6 mi. w. of Hwy. 41 on the Hillman to Estrella rd., *Epling* 735 (6); 6.1 mi. s. of U. S. Hwy. 466 on the rd. to Simmler, *Lewis & Epling* 715 (3); near Adelaida, *Lewis & Epling* 692 (9).

DELPHINIUM GYPSOPHILUM Ewan, *Tetraploid* (2n = 32) (Fig. 2)

FRESNO CO.: 5.5 mi. n. of Coalinga on Hwy. 33, *Lewis & Meblquist* 451 (3); 7.2 mi. n. of Coalinga on Hwy. 33, *Lewis & Epling* 537, *Lewis & Meblquist* 455 (9); 13.6 mi. n. of Coalinga on Hwy. 33, *Meblquist* 414, *Lewis & Meblquist* 454 (5); 14.9 mi. n. of Coalinga on Hwy. 33, *Lewis & Epling* 530 (38); 5.2 mi. w. of Coalinga on Hwy. 198, *Lewis & Meblquist* 441 (48).

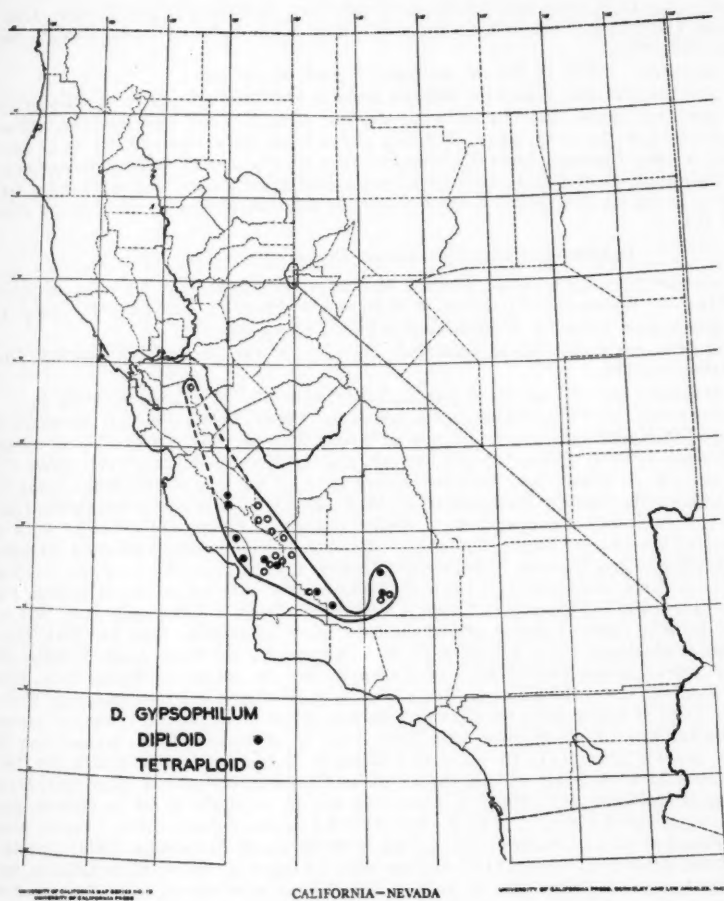


Fig. 2. Distribution of *D. gypsophilum* showing stations from which plants have been examined cytologically.

KERN CO.: about 2 mi. e. of McKittrick, Mehlquist & Wyckoff 332 (4); 8.7 mi. w. of McKittrick, Apr. 23, 1943, Lewis & Epling (25); Cottonwood Pass on Hwy. 41, 0.6 mi. e. of the San Luis Obispo Co. line, Apr. 24, 1943, Lewis & Epling (13); 0.4 mi. e. of Caliente R. R. Station, Lewis & Epling 493 (5); 1 mi. w. of Caliente R. R. Station, Lewis & Epling 494, Epling 585 (20); 4.2 mi. w. of Caliente R. R. Station, Apr. 22, 1943, Lewis & Epling (6); U. S. Hwy. 466, 0.4 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, Lewis & Epling (6); U. S. Hwy. 466, 0.9 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, Lewis & Epling (4); U. S. Hwy. 466, 1.0 mi. n. of the w. rd. to Caliente, Lewis & Epling 529 (10); U. S. Hwy. 466, 2.9 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, Lewis &

*Epling* (3); U. S. Hwy. 466, 3.0 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (12); U. S. Hwy. 466, 4.2 mi. n. of the w. rd. to Caliente, *Lewis, Epling & Meblquist* 458 (9).

KINGS CO.: hills e. of Avenal, *Meblquist & Blodgett* 331 (6).

SAN JOAQUIN CO.: 1 mi. e. of Midway, *Lewis & Meblquist* 452, *Epling & Miles* 543 (4).  
 SAN LUIS OBISPO CO.: 2.8 mi. e. of the jtn. of U. S. Hwy. 466 and Hwy. 41 near Cholame, Apr. 24, 1943, *Lewis & Epling* (31); U. S. Hwy. 466, 1.4 mi. e. of jtn. of Hwy. 41 near Cholame, *Lewis & Epling* 713 (9); 6.1 mi. s. of U. S. Hwy. 466 on the rd. to Simmler, *Lewis & Epling* 715 (1); 5.1 mi. n. e. of Creston on the rd. to Shandon, *Lewis* 816 (1); 5.2 mi. s. w. of U. S. Hwy. 41 on the Shandon to Creston rd., *Lewis & Epling* 821 (1).

DELPHINIUM HANSENI Greene, *Diploid* ( $2n = 16$ ) (Fig. 3)

AMADOR CO.: 2.6 mi. n. of Jackson, May 20, 1945, *Epling* (1); 3.5 mi. s. of Jackson on Hwy. 49, *Epling* 584 (3); 3.7 mi. s. of Jackson on Hwy. 49, May 20, 1945, *Epling* (6).

BUTTE CO.: 2.5 mi. e. of Oroville city limits, *Epling* 666 (1).

CONTRA COSTA CO.: Marsh Creek Rd., 5.8 mi. e. of the Curry Creek Park Rd., *Lewis & Epling* 703 (3).

ELDORADO CO.: 0.5 mi. w. of Garden Valley, May 26, 1941, *Lewis & Epling* (1).

KERN CO.: 10 mi. e. of Hwy. 65 on the rd. to Woody, *Epling* 560 (1); 1.9 mi. sw. of Woody, *Meblquist* 338 (1); 3.1 mi. s. w. of Woody, May 18, 1945, *Epling* (9); 3.6 mi. s. w. of Woody, *Lewis & Epling* 528 (9); 5.3 mi. s. w. of Woody, May 18, 1945, *Epling* (7); 5.5 mi. s. w. of Woody, May 18, 1945, *Epling* (5); 3.7 mi. s. of White River, *Epling* 501 (6); Glennville Church, *Meblquist & Wyckoff* 327 (3); 1.2 mi. e. of Glennville, *Lewis, Epling & Meblquist* 469 (5); 2 mi. e. of Onyx, *Lewis & Epling* 484 (16); 3.7 mi. e. of mouth of Kern River Canyon, *Meblquist & Wyckoff* 323 (3); about 5 mi. e. of the mouth of the Kern River Canyon, *Meblquist & Wyckoff* 322 (3); 6.1 mi. e. of the mouth of the Kern River, *Meblquist* 337, *Lewis & Meblquist* 465 (6); 1.0 mi. w. of Bodfish, Apr. 30, 1946, *Lewis & Epling* (1); 3.6 mi. s. of Bodfish, *Lewis & Epling* 485 (16); 10.1 mi. s. of Bodfish, *Lewis & Epling* 487 (16); 12.5 mi. s. of Bodfish, May 24, 1943, *Lewis, Epling & Meblquist* (13); 1.3 mi. e. of the cemetery, Walker Basin, *Lewis & Epling* 488 (30); Oiler Canyon Rd., 3.5 mi. s. of the jtn. at the s. w. margin of Walker Basin, *Lewis & Epling* 489 (14); Oiler Canyon Rd., 6.5 mi. s. of the jtn. at the s. w. margin of Walker Basin, *Lewis & Epling* 490 (3); Oiler Canyon Rd., 8.5 mi. s. of the jtn. at the s. w. margin of Walker Basin, *Lewis & Epling* 492 (20); 1 mi. w. of Caliente R. R. Station, Apr. 22, 1943, *Lewis & Epling* (1); 3.5 mi. w. of Caliente R. R. Station, *Lewis & Epling* 495 (19); 1.8 mi. e. of U. S. Hwy. 466 on the w. rd. to Caliente, *Meblquist & Lewis* 437, *Lewis, Epling & Meblquist* 457 (8); U. S. Hwy. 466, 0.4 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (1); U. S. Hwy. 466, 0.6 mi. n. of the w. rd. to Caliente, *Lewis & Epling* 496 (7); U. S. Hwy. 466, 1.5 mi. n. of the w. rd. to Caliente, *Epling* 559, Apr. 22, 1943, *Lewis & Epling* (31); U. S. Hwy. 466, 1.8 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (7); U. S. Hwy. 466, 2.0 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (3); U. S. Hwy. 466, 2.3 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (4); U. S. Hwy. 466, 2.9 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (37); U. S. Hwy. 466, 3.0 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (3); U. S. Hwy. 466, 3.4 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (4); U. S. Hwy. 466, 3.8 mi. n. of the w. rd. to Caliente, Apr. 22, 1943, *Lewis & Epling* (4); U. S. Hwy. 466, 4.2 mi. n. of the w. rd. to Caliente, *Lewis, Epling & Meblquist* 459, 461 (21); U. S. Hwy. 466, 4.1 mi. e. of the w. rd. to Caliente, *Lewis & Epling* 500 (13).

MADERA CO.: Madera to Raymond Rd., 1.1 mi. e. of the jtn. with the Chowchilla Rd., *Epling* 564 (4); Raymond to Coarsegold Rd., 4.9 mi. e. of the jtn. to Knowles, *Epling* 568 (1); 1.0 mi. s. of Raymond, *Epling* 567 (2); 1.4 mi. s. of Raymond, *Epling* 566 (3); 1.6 mi. s. of Raymond, *Epling* 565 (2).

MARIPOSA CO.: 6.8 mi. s. of Mariposa, *Meblquist* 346 (4); Hwy. 140, 1 $\frac{1}{2}$  mi. e. of the rd. to LeGrand, *Epling* 570 (1); 8.1 mi. s. of Coulterville, *Meblquist* 347 (3); Merced River, 1.3 mi. s. of El Portal, *Lewis* 761 (2).



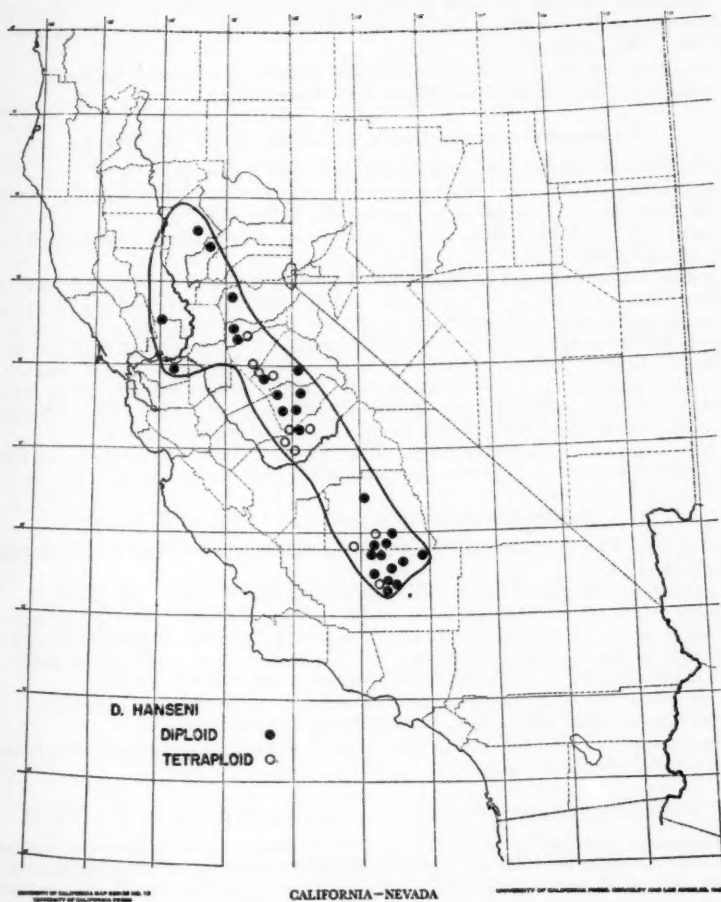


Fig. 3. Distribution of *D. hansenii* showing stations from which plants have been examined cytologically.

TULARE CO.: Kern River near Durrwood, Lewis, Epling & Mehlquist 509 (5); Kern River at Welch (near Fairview), May 24, 1943, Lewis, Epling & Mehlquist (2); 1.9 mi. e. of Lemon Cove, May 18, 1945, Epling (2); 4.2 mi. e. of Lemon Cove, Epling 563 (5); 0.3 mi. n. of White River, Lewis, Epling & Mehlquist 470 (1); 0.7 mi. n. of White River, Lewis, Epling & Mehlquist 472 (2); 1.0 mi. n. of White River, Mehlquist & Wyckoff 329 (2); about 1.5 mi. n. of White River, Mehlquist & Wyckoff 330 (3); 1.9 mi. n. of White River, May 18, 1945, Epling (4); 2.6 mi. n. of White River, Lewis, Epling & Mehlquist 473 (1).

TUOLUMNE CO.: 4.8 mi. e. of Mather Ranger Station, *Epling* 770 (6); 5.9 mi. e. of Mather Ranger Station, *Epling* 771 (4); Jacksonville, 0.6 mi. w. of the jtn. of Hwy. 49 and Hwy. 120, *Epling* 579 (2).

YOLO CO.: 3.8 mi. w. of Winters, *Mehlquist & Baker* 314, *Lewis & Epling* 606 (5).

YUBA CO.: 3.4 mi. e. of Oregon House P. O., *Lewis* 764 (3).

*DELPHINIUM HANSENI* Greene, *Tetraploid* ( $2n = 32$ ) (Fig. 3)

AMADOR CO.: 2.6 mi. n. of Jackson, May 20, 1945, *Epling* (4).

CALAVERAS CO.: 1.6 mi. n. of Copperopolis Ranger Station on Hwy. 4, *Epling* 582 (4); 4.5 mi. n. of Hwy. 120 on the rd. to Copperopolis, *Epling* 581 (4).

KERN CO.: U. S. Hwy. 466, 4.2 mi. n. of the w. rd. to Caliente, *Mehlquist & Lewis* 425, 426, 427, 460 (81).

MADERA CO.: Coarsegold to Madera Rd., 0.6 mi. s. of Raymond Rd., *Epling* 569 (2); Madera to Raymond Rd., 1.1 mi. e. of jtn. with Chowchilla Rd., *Epling* 564 (2); 1.7 mi. n. of the viaduct over the Fresno River at Madera, *Epling & Miles* 544 (1); 4.7 mi. n. of Madera, *Mehlquist* 345A (5); 5 mi. n. of Madera, *Lewis & Mehlquist* 438 (3); 10 mi. n. of Madera, *Lewis & Mehlquist* 432, 433 (4); 13 mi. n. of Madera, *Mehlquist* 345B (3).

TULARE CO.: 1.6 mi. n.e. of Richgrove, *Lewis, Epling & Mehlquist* 475, *Epling & Miles* 540 (1); 0.7 mi. n. of White River, *Mehlquist & Wyckoff* 328, *Lewis, Epling & Mehlquist* 471 (20); 2.6 mi. n. of White River, *Lewis, Epling & Mehlquist* 474 (4).

TUOLUMNE CO.: Jacksonville, 0.6 mi. w. of the jtn. of Hwy. 49 and Hwy. 120, *Epling* 578 (4); 0.5 mi. n.w. of Jamestown on the Tuttle town Rd., *Epling* 723 (1).

*DELPHINIUM HESPERIUM* Gray ( $2n = 16$ ) (Fig. 4)

LAKE CO.: 5 mi. e. of the Lake Co. line on the Lakeport to Hopland Rd., *Lewis, Epling & Stebbins* 516 (4).

MENDOCINO CO.: 9.6 mi. s. of Rock Creek, *Mehlquist & Jenkins* 366 (2).

NAPA CO.: 6 mi. s. of Monticello on the rd. to Napa, *Mehlquist* 355 (3); 6.8 mi. s. of Monticello on the rd. to Napa, *Mehlquist & Paddock* 308, *Mehlquist* 356 (4); 7 mi. s. of Monticello on the rd. to Napa, *Mehlquist* 357 (2); 8.4 mi. s. of Monticello on the rd. to Napa, *Mehlquist* 358 (2); Wooden Valley, *Mehlquist* 400 (1).

SAN MATEO CO.: Page Mill Rd., near Stanford Univ., *Lewis & Epling* 436 (3).

SANTA CLARA CO.: Uvas Creek, *Lewis & Epling* 435 (2).

SONOMA CO.: 1 mi. e. of Bodega Bay, *Lewis & Epling* 515 (2); Mark West Springs, *Mehlquist & Jenkins* 362 (5).

*DELPHINIUM HESPERIUM* Gray forma *PALLESCENS* Ewan ( $2n = 16$ ) (Fig. 4)

This entity, described by Ewan (1945) as *D. hesperium* forma *pallescens*, is most conspicuously distinguished from the typical form by its white or pinkish flowers and is a readily recognized geographical race of the drier more interior foothills of the Coast Ranges (fig. 4). In our opinion it unquestionably warrants subspecific status. The combination required will be made in another publication.

CONTRA COSTA CO.: Marsh Creek Rd., 1 mi. w. of Curry Creek Park Rd., *Lewis & Epling* 702 (1); rd. to Livermore, 0.1 mi. s. of the Marsh Creek Rd., *Lewis & Mehlquist* 444 (3); Beck Rd. (to Livermore), 1.0 mi. s. of the Marsh Creek Rd., *Lewis & Epling* 589 (22); Beck Rd. (to Livermore), 1.2 mi. s. of the Marsh Creek Rd., May 6, 1944, *Lewis & Epling* (5); rd. to Antioch, 4.5 mi. n. of the Marsh Creek Rd., *Lewis & Mehlquist* 446 (5); Antioch Golf Course, *Lewis & Mehlquist* 445 (5).

LAKE CO.: 2.7 mi. n. of Clear Lake on rd. to Stubbs, *Mehlquist & Jenkins* 364 (1).

NAPA CO.: 2 mi. n. of Knoxville on the rd. to Reiff, *Mehlquist & Paddock* 309, *Mehlquist & Baker* 319 (5); 4.6 mi. s. of Monticello on Napa Rd., *Mehlquist* 354 (3).

SAN BENITO CO.: 0.5 mi. s. of Paicines, *Lewis & Mehlquist* 450 (4); 2.8 mi. s. of the entrance to the Pinnacles, *Lewis & Mehlquist* 449 (3); 4.1 mi. s. of Pinnacles P. O., *Mehlquist* 386 (6); 9.9 mi. s. of Paicines, *Lewis & Epling* 709 (4).

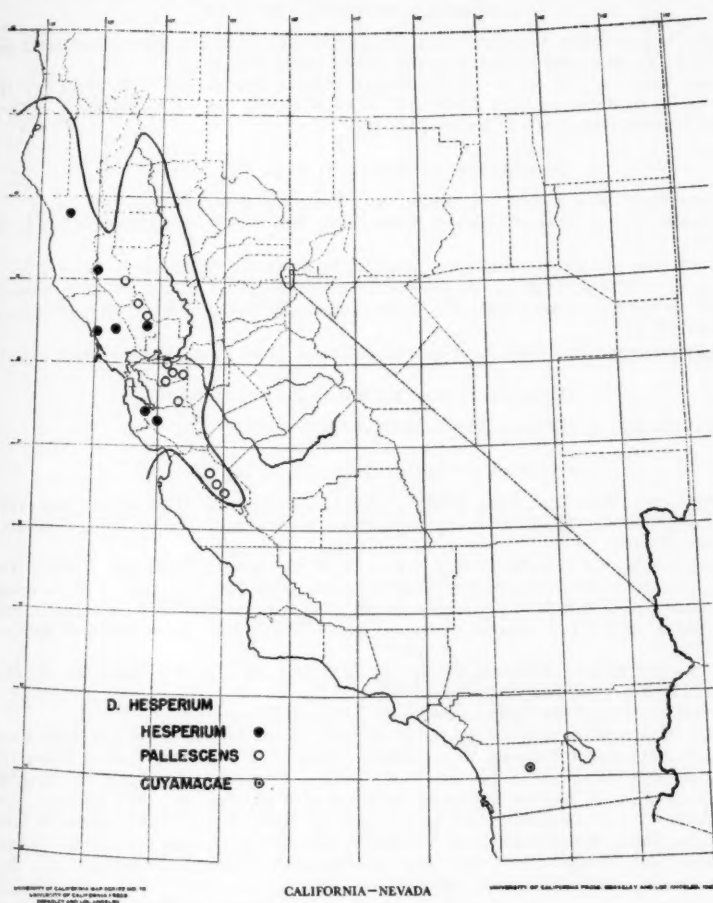


Fig. 4. Distribution of *D. hesperium* showing stations from which plants have been examined cytologically.

YOLO CO.: Putah Creek Canyon, 8 mi. w. of Winters, *Meblquist & Baker* 315 (4).

DELPHINIUM HESPERIUM Gray var. CUYAMACAE (Abrams) Jeps. ( $2n = 16$ ) (Fig. 4)

SAN DIEGO CO.: Cuyamaca Lake, *Meblquist & Geissman* 403, *Ensign & McClintock* 554 (9).

## DELPHINIUM INOPINUM (2n = 16)

We have evidence to indicate that *D. parishii* var. *inopinum* Jeps. represents a good species. The new combination required will be made elsewhere.

VENTURA CO.: 1.0 mi. w. of Chuchupate Ranger Station, Ball 807, Lewis 639 (3); 13.2 mi. s. of Ozena on U. S. Hwy. 399, Lewis & Epling 755 (1); 13.6 mi. s. of Ozena on U. S. Hwy. 399, Lewis & Epling 756 (2).

## DELPHINIUM NUDICAULE T. &amp; G. (2n = 16)

HUMBOLDT CO.: S. Fork Van Duzen Rd., Meblquist & Jenkins 375 (3).

MODOC CO.: s. slope of Caldwell Butte, Lava Beds Nat'l. Mon., Meblquist & Jenkins 379 (5).

NAPA CO.: 12 mi. n. of Monticello on rd. to Knoxville, Meblquist & Baker 318 (3); 11 mi. n. of Monticello on rd. to Knoxville, Meblquist 350 (3); 16.5 mi. s. of Monticello on rd. to Napa, Meblquist 359 (4); Nuns Canyon, Meblquist & Baker 321, Meblquist & Jenkins 361 (5).

SANTA CRUZ CO.: 0.9 mi. n. of Brookdale Resort, Santa Cruz Mts., Meblquist 383 (3).

## DELPHINIUM NUTTALLIANUM Pritz. (2n = 16)

NEVADA CO.: Soda Springs Hotel, Meblquist & Jenkins 381 (5).

## DELPHINIUM PARISHII Gray (2n = 16) (Fig. 5)

INYO CO.: Westgaard Pass, Bobart 419 (1); Canyon near Hells Gate, Death Valley Nat'l. Mon., Lewis & Lowe 682 (3); Emigrant Canyon, Death Valley Nat'l. Mon., Lewis & Lowe 681 (4).

KERN CO.: road to Cuddy Valley, 0.1 mi. n. of the Cuyama Valley Rd., Lewis & Dunn 478 (6); 1.0 mi. w. of Chuchupate Ranger Station, Lewis 749 (1); 1 mi. e. of the summit of Walker Pass, Lewis, Epling & Meblquist 467 (2); Summit of Walker Pass, Lewis, Epling & Meblquist 466 (2); 7.1 mi. w. of the summit of Walker Pass, Lewis, Epling & Meblquist 468 (1).

LOS ANGELES CO.: Palmdale, Epling 745 (2); 23.5 mi. e. of Palmdale, Apr. 17, 1941, Lewis & Epling (1); near Lancaster, Meblquist (5).

RIVERSIDE CO.: Palm Springs, mouth of Tahquitz Canyon, Lewis 811 (1).

SAN BERNARDINO CO.: 4.9 mi. n. of the jtn. of the Mojave River and Deep Creek, Apr. 25, 1941, Lewis & Epling (1); Morongo Valley, Apr. 27, 1941, Lewis & Epling (1); grade between Morongo Valley and Yucca Valley, Meblquist 333, Lewis & Epling 508 (15); 4.8 mi. s. of Barstow on the rd. to Stoddard Well, Apr. 27, 1941, Lewis & Epling (1); 8.2 mi. s. of Barstow on the rd. to Stoddard Well, Apr. 27, 1941, Lewis & Epling (1); the Mojave River Narrows at Victorville, Apr. 27, 1941, Lewis & Epling (1); near Baldwin Lake, Meblquist 421, 422, 424 (6); Holcomb Valley, Meblquist 420 (1); Avawatz Mts., C. Wolf (Meblquist 303) (1).

SAN DIEGO CO.: 1.2 mi. w. of bridge in Sentenac Canyon, Meblquist & Geissman 407 (2); 2.4 mi. w. of bridge, Meblquist & Geissman 408 (2); mouth of Coyote Canyon, Meblquist & Geissman 409 (2); mouth of Borego Palm Canyon, Meblquist & Geissman 410 (2).

## DELPHINIUM PARRYI Gray (2n = 16) (Fig. 5)

INYO CO.: Sherman Hills above Paradise Camp, n. of Bishop, Bobart 419 (2).

LOS ANGELES CO.: Santa Catalina Island, west end of Whitley Ave., Avalon, Lewis 631 (1); Mulholland Drive e. of Topanga Canyon Rd., Meblquist & Wyckoff 391, 392 (5); Lopez Canyon, Meblquist 312, 40016 (9).

MONTEREY CO.: 1.0 mi. w. of the jtn. at Pleyto, Lewis & Epling 695 (4); 1.5 mi. w. of the jtn. at Pleyto, Lewis & Epling 696 (2); Bradley to Jolon Rd., at jtn. with Pleyto Rd., Levine 774 (1).

RIVERSIDE CO.: Santa Rosa Summit, Lewis & Epling 482 (1); 3 mi. s. of Banning on the rd. to Idyllwild, Meblquist 334 (3).

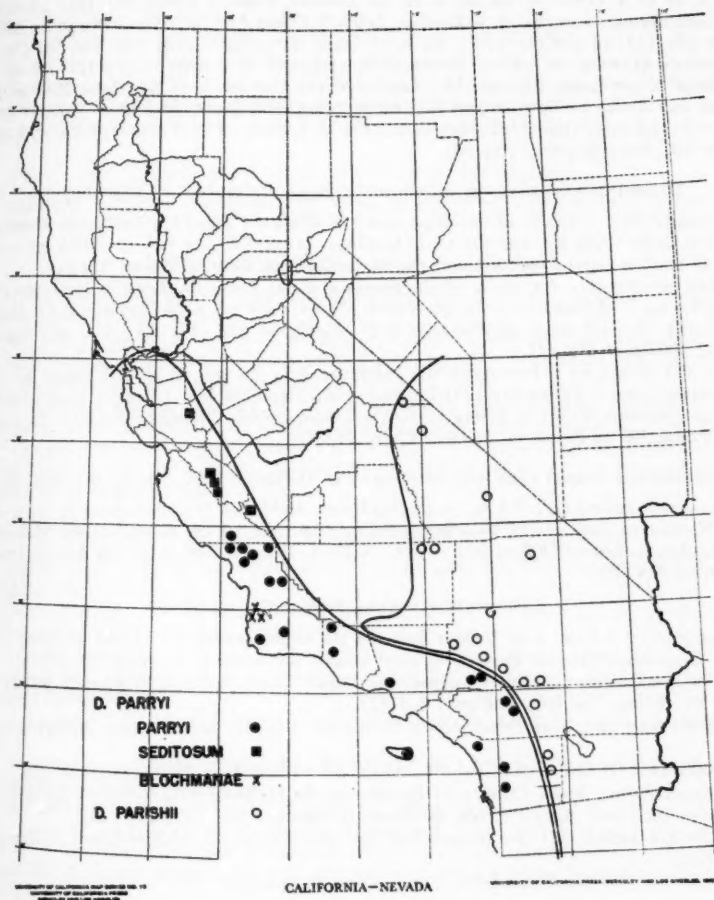


Fig. 5. Distribution of *D. parryi* and *D. parishii* showing stations from which plants have been examined cytologically.

SAN BERNARDINO CO.: Cedar Springs, *Lewis & Epling* 534 (1); 5 mi. n. of Verdement, Apr. 1944, *Lewis* (1); near the Zanja, Mentone, Apr. 20, 1946, *Lewis* (1).

SAN DIEGO CO.: Lakeside Park, *Froelich* 313 (4); Ramona, *Mehlquist* 307 (4); near Fallbrook, *Mehlquist & Eggers* 393 (2).

SAN LUIS OBISPO CO.: 1.9 mi. w. of Pozo, May 24, 1941, *Lewis & Epling* (1); 6.1 mi. s. of U. S. Hwy. 466 on rd. to Simmler, *Lewis & Epling* 714 (2); 7.1 mi. w. of Simmler, *Lewis & Epling* 501 (7); 4.1 mi. s. and 1.1 mi. e. of Atascadero, *Dunn & Brown* 2383 (1); 1.5 mi. s. of Klau, *Lewis & Epling* 662 (3); 8.5 mi. n.w. of Adelaida Cemetery, *Lewis & Epling* 650 (2); 9.3 mi. n.w. of Adelaida Cemetery, *Lewis & Epling* 658 (3); 9.9



mi. w. of U. S. Hwy. 101 on the n. rd. to Adelaida, *Lewis & Epling* 687 (2); 3.5 mi. e. of Santa Margarita on the rd. to Creston, *Lewis & Epling* 653 (2); Santa Margarita, *Mehlquist* 389 (5); rd. to Creston, 4.2 mi. n. of Santa Margarita to Pozo Rd., *Ball* 802 (3).

SANTA BARBARA CO.: Davy Brown Camp, Figueroa Mt., *Epling* 477 (12); 0.8 mi. s. of Davy Brown Camp, Figueroa Mt., *Lewis* 720 (7); 1.1 mi. n. of Red Rock Mine on the Santa Inez Valley to Davy Brown Rd., *Lewis* 722 (3); Lompoc, *Mehlquist* 399, 481 (3).

VENTURA CO.: Ojai, 1942, *Mehlquist* (1); U. S. Hwy. 399, 9 mi. s. of jtn. with Mt. Pinos Rd., *Lewis & Epling* 754 (6).

*DELPHINIUM PARRYI* ssp. *SEDTIOSUM* (Jeps.) Ewan (2n = 16) (Fig. 5)

FRESNO CO.: 6 mi. w. of Coalinga, *Lewis & Mehlquist* 434 (2); 7.6 mi. w. of jtn. of the Los Gatos Creek Rd. and the rd. to Coalinga, *Lewis & Epling* 628 (1); 10.9 mi. w. of jtn. of the Los Gatos Creek Rd. and the rd. to Coalinga, *Lewis & Epling* 624 (1).

SAN BENITO CO.: 0.4 mi. n. of the entrance to the Pinnacles, *Lewis & Mehlquist* 456 (2); 9.4 mi. s. of Pinnacles P. O., *Mehlquist* 388 (4); 2.9 mi. n. of Pinnacles P. O., *Mehlquist* 385 (2); 6.7 mi. n. of Pinnacles P. O., *Mehlquist* 384 (3); 5.1 mi. s. of Pinnacles P. O., *Mehlquist* 387 (2).

SANTA CLARA CO.: Livermore-Mt. Hamilton Rd., 0.9 mi. n. of Del Puerto Rd. to Patterson, *Lewis & Epling* 610 (2); Livermore-Mt. Hamilton Rd., 1.8 mi. n. of Del Puerto Rd. to Patterson, *Lewis & Epling* 609 (1); Livermore-Mt. Hamilton Rd., 1.3 mi. s. of Del Puerto Rd. to Patterson, *Lewis & Epling* 615 (1).

*DELPHINIUM PARRYI* Gray var. *BLOCHMANAE* (Greene) Jeps. (2n = 16) (Fig. 5)

SAN LUIS OBISPO CO.: 5.5 mi. n. of Guadalupe, *Mehlquist* 513 (3); dunes to the w. of the Nipomo to Guadalupe Rd., *Lewis & Epling* 504 (9); 5.3 mi. n. of Veterans Memorial in Guadalupe, *Lewis & Epling* 685 (4); U. S. Hwy. 101, 11.1 mi. n. of Los Alamos, *Lewis & Epling* 505 (8).

*DELPHINIUM PATENS* Benth. (2n = 16)

KERN CO.: 6.5 mi. s. of Walker Basin on the Oiler Canyon Rd., *Lewis & Epling* 491 (1); Kern River Canyon, about 5 mi. e. of mouth, *Mehlquist & Wyckoff* 326 (3).

LOS ANGELES CO.: Pacoima Canyon, San Gabriel Mts., *Mehlquist & Froelich* 306 (5); near Mt. Wilson Toll Rd., *Mehlquist* 398 (2).

MONTEREY CO.: near Priest Valley, *Mehlquist* 298 (2); near Aromas, *Mehlquist* 299 (2).

NAPA CO.: 11 mi. n. of Monticello, on the rd. to Knoxville, *Mehlquist* 316A (1).

RIVERSIDE CO.: about 15 mi. s. of Banning on the Idyllwild Rd., *Mehlquist* 335 (5).

SAN DIEGO CO.: Banner Grade, *Mehlquist & Geissman* 405 (3); 406 (2).

SANTA BARBARA CO.: San Marcos Pass Rd., 5 mi. n. of San Marcos Ranch, *Mehlquist* 390 (3).

VENTURA CO.: Mt. Pinos Public Camp, *Lewis & Dunn* 480 (1).

*DELPHINIUM POLYCLADON* Eastw. (2n = 16)

MARIPOSA CO.: e. end of Lake Teneya, Aug. 22, 1941, *Lewis* (1).

*DELPHINIUM PURPUSH* Brandg. (2n = 16)

KERN CO.: about 2 mi. e. of the mouth of the Kern River Canyon, *Mehlquist & Wyckoff* 324 (3); 5.0 mi. e. of the mouth, *Lewis, Epling & Mehlquist* 464 (1); 3.7 mi. e. of the mouth, *Mehlquist* 336 (5).

*DELPHINIUM RECURVATUM* Greene (2n = 16)

CONTRA COSTA CO.: 0.5 mi. w. of Hwy. 120 on the Byron Hot Springs Rd., *Epling & Miles* 542 (3).

FRESNO CO.: 7.2 mi. n. of Coalinga on Hwy. 33, *Mehlquist* 412 (3); 13.6 mi. n. of Coalinga on Hwy. 33, *Mehlquist* 413, *Lewis & Mehlquist* 453 (11).

DELPHINIUM TROLLIIFOLIUM Gray ( $2n = 16$ )

HUMBOLDT CO.: 1.5 mi. n. of Kneeland, *Meblquist & Jenkins* 367 (3); Yager Creek, *Meblquist & Jenkins* 370 (3); Yager Creek bridge, 8 mi. n. of Bridgeville, *Meblquist & Jenkins* 371 (2); 16.2 mi. n. of Bridgeville, *Meblquist & Jenkins* 372 (1); 1.1 mi. w. of South Fork Van Duzen Rd. on rd. to Dinsmore, *Meblquist & Jenkins* 373 (1).

DELPHINIUM ULIGINOSUM Curran ( $2n = 16$ )

LAKE CO.: 2.7 mi. e. of Middletown on rd. to Lower Lake, *Meblquist & Baker* 320, *Meblquist & Jenkins* 363 (10).

DELPHINIUM UMBRACULORUM ( $2n = 16$ )

*Delphinium umbraculorum* is an undescribed species. A formal taxonomic description will be presented elsewhere.

SAN LUIS OBISPO CO.: 3.7-4.0 mi. s. of Klau, *Lewis & Epling* 663, 691 (3); King City to Jolon Rd., 1.2 mi. n. of Avila, *Lewis & Epling* 701, 781 (1); Santa Margarita-Pozo Rd., 10.6 mi. e. of rd. to Creston, *Lewis* 813 (1).

SANTA BARBARA CO.: San Rafael Mts., Davy Brown Camp Ground, *Lewis* 717 (3); 0.8 mi. n. of Davy Brown Camp Ground, *Lewis & Mathias* 791 (1); 1.4 mi. n. of Davy Brown Camp Ground, *Lewis* 718, *Lewis & Mathias* 792 (3); about 5 mi. w. of Las Cruces-Lompoc Rd. on the rd. to Jalama, *Meblquist* 512 (2); 0.3 mi. w. of Las Cruces-Lompoc Rd. on rd. to Jalama, *Lewis* 767 (8).

DELPHINIUM VARIEGATUM T. & G., *Diploid* ( $2n = 16$ ) (Fig. 6)

ALAMEDA CO.: 10.7 mi. s. of Livermore P. O. on the Tesla-Corral Hollow Rd., *Lewis & Epling* 608 (15).

CALAVERAS CO.: 7.8 mi. s. of Mokelumne Hill, *Epling* 583 (4); 4.5 mi. n. of Hwy. 120 on the rd. to Copperopolis, *Epling* 580 (1).

CONTRA COSTA CO.: rd. to Livermore, 0.1 mi. s. of the Marsh Creek Rd., *Lewis & Meblquist* 443 (6); 1.0 mi. s. of the Marsh Creek Rd. on the Beck Rd. to Livermore, *Lewis & Epling* 589 (5).

LAKE CO.: Lake-Napa County line, rd. Knoxville to Reiff, *Meblquist & Paddock* 311 (3).

MARIPOSA CO.: 3.8 mi. n. of Bagby, *Epling* 572 (3); Hwy. 140, 16 mi. e. of the rd. to Le Grand, *Epling* 571 (5).

MENDOCINO CO.: 5.2 mi. s. of Willits on U. S. Hwy. 101, *Meblquist & Jenkins* 365 (2).

NAPA CO.: 16.2 mi. n. of Monticello, *Meblquist & Baker* 318, *Meblquist* 351 (9); 2 mi. n. of Knoxville, *Meblquist & Paddock* 309 (5); 6.8 mi. n. of Monticello on rd. to Knoxville, *Meblquist & Baker* 316 (3); 0.7 mi. s. of Nuns Canyon, *Meblquist & Jenkins* 360 (3).

SAN LUIS OBISPO CO.: 2.9 mi. w. of Pozo, *Lewis & Epling* 502 (12); 7.8 mi. w. of Pozo, Apr. 24, 1943, *Lewis & Epling* (10); near Santa Margarita, *Lewis & Epling* 503 (6).

SANTA CLARA CO.: Mt. Hamilton, *Paddock* 402 (3); Livermore to Mt. Hamilton Rd., 0.2 mi. w. of Mines Rd., *Lewis & Epling* 611 (1); Livermore to Mt. Hamilton Rd. at jtn. with Del Puerto Rd. to Patterson, *Lewis & Epling* 613 (2).

TULARE CO.: Pleasant Valley (near Springville), *Lewis & Epling* 526 (1).

TUOLUMNE CO.: 5.5 mi. e. of Hangman's Tree, Bret Harte, *Epling* 730 (1); Hwy. 108 at jtn. with rd. to Soulsbyville, *Epling* 576 (3).

PLACER CO.: Weimar, *Meblquist & Jenkins* 382 (5).

DELPHINIUM VARIEGATUM T. & G., *Tetraploid* ( $2n = 32$ ) (Fig. 6)

ELDORADO CO.: 0.5 mi. w. of Garden Valley, *Lewis & Epling* 442 (2).

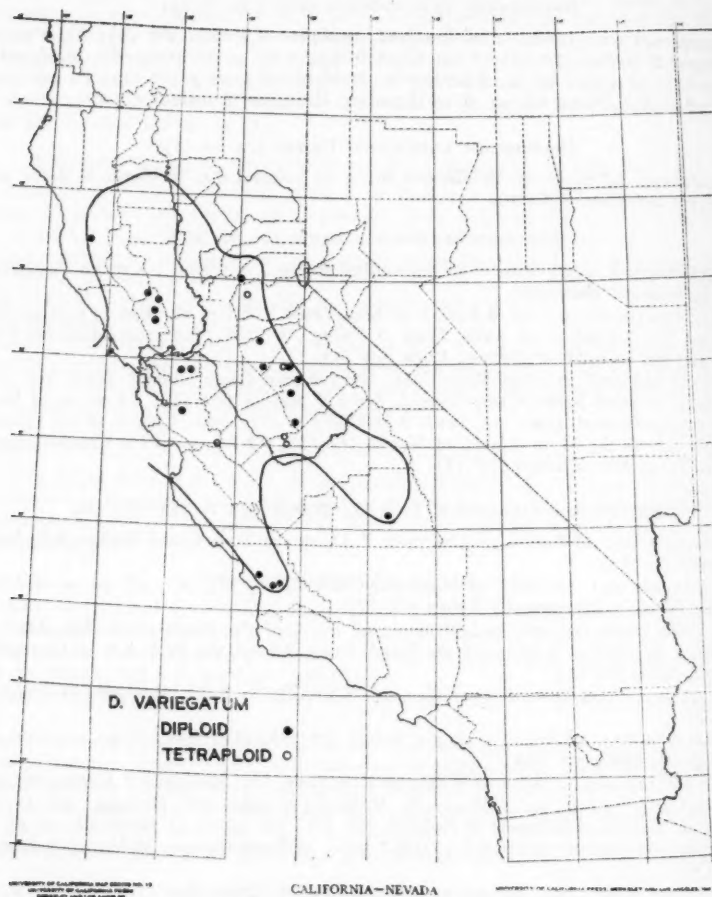


Fig. 6. Distribution of *D. variegatum* showing stations from which plants have been examined cytologically.

MADERA CO.: 0.5 mi. n. of the n. end of the bridge over the Fresno R. at Madera, Epling & Miles 541 (2); 10 mi. n. of Madera, Lewis & Meblquist 433 (3); 21.8 mi. s. of Merced, Lewis & Meblquist 447 (7).

MERCED CO.: Pacheco Pass, Meblquist 416, 417 (9).

TUOLUMNE CO.: Hwy. 108, 0.7 mi. e. of the rd. to Soulsbyville, Epling 575 (5).

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## STUDIES IN THE APOCYNACEAE. VIII<sup>1</sup>

AN INTERIM REVISION OF THE GENUS *ASPIDOSPERMA* MART. & ZUCC.

ROBERT E. WOODSON, JR.

Contemporary systematic botany in South America has attained to such a high degree of proficiency and eminence that a word of apology, at least, becomes the outland botanist who undertakes a taxonomic revision of an almost wholly South American genus. I am able to make excuse with a whole heart for attempting a revision of the apocynaceous genus *Aspidosperma*, for I had truly hoped never to feel called upon to do so. There are numerous South American botanists, particularly in Brazil, who could present a much more detailed picture of the variation and system of the genus than I.

The species of *Aspidosperma* are very widespread and frequent trees in tropical America; and since I am regarded in certain quarters as something of an authority on the Apocynaceae, many specimens of the genus have been submitted to me for naming over a period of years. From the very first I was vexed by the lack of decisive criteria in the literature and baffled by discordant specimens filed under the same name in our herbaria. I soon became aware that I, myself, was contributing to the confusion in both respects. The need for a revision was all too apparent.

The publication of this study of the genus, and at this time, has a rather fortuitous history. One day in the year 1938, I was writing to Dr. K. H. Rechinger, of Vienna, in connection with a loan of Apocynaceae which was being returned to him. After telling him how greatly I had profited from his kindness, I remarked wistfully that "someday" I hoped to request the loan of his *Aspidospermas* which I knew would be rich in the older types required by a monographic study. Out of the goodness of his heart, Dr. Rechinger must have misunderstood my intentions, for, to my consternation, all of the *Aspidospermas* in the Naturhistorisches Museum descended upon me by return mail! Since I was already engrossed in another major project at the time and needed encouragement for an additional task, I wrote for counsel from my old friend, Dr. Friedrich Markgraf. To my relief, he replied that Dr. J. G. Kuhlmann, of Rio de Janeiro, was already engaged in a study of *Aspidosperma*: professional ethics appeared to have furnished me an alibi, and I could return the *Aspidospermas* to Vienna with a clear conscience! I thereupon relinquished the loan to my herbarium superior for the required "official transmittal."

Within three months central Europe was in turmoil; but for me, fresh horror was added when I learned that my loan had *not* been forwarded, as I had trusted, and could not then be sent with safety. Unstudied, yet, the Viennese *Aspidospermas* reposed first in neutral and later in "enemy" internment for nearly ten years!

<sup>1</sup>Issued June 18, 1951.

All this time unnamed *Aspidospermas* continued to arrive, and I continued to make my haphazard way amongst them with increasing misgivings. Finally I wrote to Dr. Kuhlmann in desperation for news of the long-awaited revision, but without reply. After a second and a third unanswered inquiry, my impulse toward revising *Aspidosperma*, chiefly for my own use, could be repressed no longer, and the Vienna loan with its precious types was unpacked again and put to tardy use; at length being returned to Dr. Rechinger in 1949. Later, Dr. Kuhlmann responded by forwarding to me generous portions from the types of several of his species of *Aspidosperma*. These specimens, not represented in any North American or European herbarium, have been invaluable to me.

*Aspidosperma* has been in need of a revision for many years. As a matter of fact, not even a complete presentation of the literature alone has been prepared since the publication of A. de Candolle's treatment for the 'Prodrromus' in 1844. Probably well over 100 species have been described since that time. Jean Mueller's account for 'Flora Brasiliensis' in 1860 is roughly in synoptic form and deals with 46 names applied to the Brazilian species; but today species of *Aspidosperma* are known from every country of continental Latin America except El Salvador and Chile, as well as from Hispaniola and Trinidad.

Since Mueller's time, studies of three small groups of species have been published by Markgraf (in Notizbl. Bot. Gart. Berlin 12:553. 1935; 13:464. 1937). Pichon's perspective of the genus (in Bull. Mus. Nat. d'Hist. Nat. ser. 2, 19:362. 1947) provides a detailed analysis of a dozen more or less natural sections with enumerations of representative species for each, but without keys to the species and without synonymy; however, it is such a major contribution toward alleviation of the chaos that the need for my own study is greatly reduced. Finally, even with this present study which has occupied so much of my attention for several months, tropical American dendrology still requires the field observations of Dr. Kuhlmann, and the appearance of his investigations of *Aspidosperma* will be awaited by no one more eagerly than me.

#### GENERAL MORPHOLOGY

*Habit.*—The species of *Aspidosperma* are trees from 2 to 60 m. in height, growing in a variety of habitats from the dry *campos* of south-central Brazil, Paraguay, and Argentina, to the inundated river margins of the Amazon valley, and at elevations from a few meters above sea level to approximately 2000 m. in eastern Peru and Bolivia. The largest and most distinctive trees are found in my series *NITIDA*, where heights of 40 m. are common, frequently with boles over 1 m. in diameter b. h. The boles of this series, also, are characterized within the genus by very striking buttresses or lamellations which are frequently noted by collectors of botanical specimens. Thickness and texture of the bark vary considerably and apparently without phylogenetic significance except in the series *NOBILES*, where, with the exception of *Aspidosperma decussatum*, obvious lenticels in the leafy twigs are absent. Probably similar environmental conditions have

resulted in very thick, corky periderm and disproportionally shortened internodes in *A. verbascifolium* and *A. tomentosum* of the series MACROCARPA and PYRICOLLA, respectively. Both are species of the Brazilian and Paraguayan *campos*.

Trees of *Aspidosperma* may be deciduous, as in series MACROCARPA and PYRICOLLA, or apparently evergreen, as in the remaining series. It is obviously difficult to ascertain vernal habits of the species without extensive field experience; my own observations are based only upon a limited number of herbarium specimens. Nevertheless, it is obvious that species of MACROCARPA bloom frequently upon leafless twigs or together with early leaves only. Twigs of these species have more or less obvious seasonal articulations; although the rounded terminal buds are apparently naked, the terminal internodes are conspicuously foreshortened—protection possibly being furnished in this way *in lieu* of bud scales. In series PYRICOLLA, however, not only are the terminal internodes shortened, but the terminal buds are protected by strongly imbricate scales. In this series, consequently, the young twigs bear conspicuous seasonal articulations. Terminal buds of series RAMIFLORA and POLYNEURA are essentially similar to those of MACROCARPA (although those of the latter apparently produce scales at times): in all four series, the bud is obviously terminal, with the subtending internode conspicuously thicker than the terminal leaf petiole.

In series NITIDA, STEGOMERIA, and NOBILES, however, the buds are naked and consist of a few leaf initials as the terminal internodes are not sensibly foreshortened. Since in these series the internode subtending the terminal bud is only of about the same thickness as that of the terminal leaf petiole, the terminal bud appears pushed to one side in a pseudo-lateral position recalling that of many species of fig, and this aspect is of aid in the casual assignment of specimens to their series.

Twigs of the QUEBRACHINES are notable within the genus in producing a characteristic bushy growth through the use of abundant axillary buds with closely imbricate scales. The twigs, however, are not conspicuously articulated.

Latex bears interesting correlation with floral and fruit characters in *Aspidosperma*: in series NOBILES the latex apparently usually is reddish, although in some parts of the plant, as in the stem, it may be white although red in the inflorescence and fruit for example. Traces of the red latex may frequently be found upon herbarium specimens. In species of POLYNEURA the latex appears generally to be colorless or opalescent and more scanty than in the other series, to judge from the notes of collectors. In the remaining series the latex is milky. The latex of no species seems to have suggested economic use, and I am not aware of any special study of it.

The wood of very many *Aspidospermas* appears to be tough and strong, and an important local source of structural timber. Other woods or bark are used as sources of tannin, or even as a substitute for quinine, due to the astringent crystalline inclusions. A special study of the wood anatomy of 29 species of *Aspidosperma* was published by Milanez (in *Physis* 15:428. 1939) and will be discussed more fully in succeeding paragraphs. It may be noted here, nevertheless, that Milanez

generally found "annual rings" in the wood of species with scaly buds, or in those with naked buds but with congested upper internodes and blooming before or with production of young leaves: "annual rings" were absent or inconspicuous in other species. A general account of the woods of *Aspidosperma*, including their economic uses, will be found in Record and Mell's 'Timbers of Tropical America', pp. 507-515 (Yale University Press, 1924).

*Leaves.*—The leaves of *Aspidosperma* frequently aid in the assignment of specimens to series, although less often to species. Phyllotaxy is alternate or approximate typically, except in *A. decussatum* of the NOBILES, which has broad decussate foliage, and in the two species of series QUEBRACHINES in which the small spine-tipped leaves are opposite or ternate apparently rather indiscriminately. Extremely useful in the separation of many species of NITIDA are the peculiar leaves with margins more or less conspicuously auriculate-revolute at the base: many species of the same series are without this character, however. Leaves of NITIDA, QUEBRACHINES, and NOBILES habitually are of coriaceous texture and those of the other series membranaceous.

Leaf venation always is pinnate: In NOBILES the secondary veins are nearly perpendicular to the midrib and appear to continue without dichotomy to the margin. In POLYNEURA and NITIDA the secondary veins are more arcuate and dichotomize to form a rather definite marginal vein close to the leaf margin; in the other series, particularly in PYRICOLLA, the broadly arcuate secondaries dichotomize and anastomose to form the marginal vein farther from the leaf margin. My series POLYNEURA coincides essentially with Pichon's section RETICULATA, which bears an appropriate name recalling the very dense and conspicuous tertiary reticulation of the habitually rather thin, pale foliage.

*Inflorescence.*—Inflorescence structure in *Aspidosperma* would furnish a separate study of considerable morphological interest because of its wide range of modification and close correlation with other morphological criteria used in the delimitation of series and species. Although the structure is basically cymose throughout, it shows definite tendencies toward indeterminate composition, particularly the thyrses.

In series MACROCARPA and STEGOMERIA the inflorescence probably shows its most simple, if not primitive structure. Here it is a terminal or, more usually, a subterminal cyme of relatively few flowers, without obvious bracts and lacking the determinate flower, at least in the lower dichotomies. The primary peduncles very frequently are attached to the stem some distance above the "subtending" leaf which bears an axillary, vegetative bud: this prompts the interpretation of the inflorescence as morphologically a determinate axis as is shown more clearly in the interpetiolar cymes of Asclepiadaceae.

Although in MACROCARPA and STEGOMERIA, which are without well-defined seasonal growth, the lateral inflorescences are spaced at moderate distances, in species of PYRICOLLA, where flowering occurs at or near the greatly condensed terminal nodes at the beginning of the season, the inflorescences (also dichotomous

cymes) become congested into a corymbiform mass. In one species of the latter series, namely *A. pyrifolium*, it is helpful to observe that the determinate flowers occur at every dichotomy to the base; this quite possibly is the original design for the "empty" dichotomies produced by other species of the genus. In the closely related *A. multiflorum*, determinate flowers may occur at the upper dichotomies although absent at the lower.

Although inflorescences of the genus habitually are terminal or subterminal upon the younger branches, in the series RAMIFLORA and STEGOMERIA the lateral inflorescences are produced much farther below the apical meristem, very frequently upon completely suberized stems, and are described as "cauliflorous" in this study.

In the series NITIDA, the rather numerous species may have either of two types of inflorescence: laterally subterminal and dichotomously cymbiform, as in PYRICOLLA, but with more or less obvious and irregularly placed but persistent bracts; or terminal and thyrsiform, also with similar bracts. The latter type, although appearing thyrsiform, actually is of the type of cyme which has been called the "aggregate dichasium" (cf. Woodson, in Ann. Missouri Bot. Gard. 22:1. 1935).

Since the ultimate terminal and lateral branches of the thyrsiform type correspond closely to the cymiform structure of the first type, the two appear to be correlated. However, whether the thyrsiform type represents a condensation of a shoot apex bearing several cymiform branches, with resultant reduction of the foliage, or whether the more simple type is a simplification of the thyrsiform, is difficult to decide. I am somewhat of the opinion that the first view is more plausible. A rather similar situation exists in the four species of series POLYNEURA, with *A. dispernum* and *A. cylindrocarpon* representing the cymiform subterminal type, *A. cuspa* the thyrsiform terminal type, and *A. polyneuron* occupying an intermediate position.

In series NOBILES the case in favor of inflorescence condensation may be followed somewhat more clearly. In what I believe to be the most "primitive" type of inflorescence, shown by that of *A. verruculosum*, the flowering axis is terminal and bears few or several alternate, rather distantly and uniformly spaced flowering branches with congested determinate divisions. In the remaining species of the series, however, the inflorescence is of a very characteristic type: terminal or subterminal with a more or less elongate naked primary peduncle, at the tip of which are borne the flowering peduncles in a congested more or less umbelliform false whorl. The degree of compounding and congestion of these varies even upon a single individual, and it is very easy to visualize the primitive condition as being that similar to *A. verruculosum*. Here in NOBILES one may observe the more or less obvious and irregularly placed bracts, such as those of NITIDA, very conspicuous in some species and quite obscure in others.

A type of inflorescence which appears to have been reduced from that of NOBILES is found in the QUEBRACHINES. Here the inflorescences are produced very abundantly in an axillary position as a rule. The axes are reduced to rela-



tively few flowers each so that the whole appears racemiform in fact; but it is interesting to observe that the branches are opposite or ternate, as are the foliage leaves. Here, although bracts are produced, they are small and caducous.

Having already written more fully concerning the inflorescence of *Aspidosperma* than my comprehension of it warrants, perhaps, I can end only in stating that while I believe there to be evidence to interpret the thyrsiform aggregate dichasium as derived from the bracteate, cymiform structures in such series as *NITIDA*, *POLYNEURA*, and *QUEBRACHINES*, the phylogenetic relationship of these to the lateral, ebracteate cymes of *PYRICOLLA*, *MACROCARPA*, and *STEGOMERIA* certainly is less than clear.

*Flowers.*—The calyx of *Aspidosperma* typically consists of five imbricate, equal or subequal segments which are free to the receptacle. They always are destitute of internal glandular squamellae. In the more advanced series, however, there is a pronounced tendency for the outermost pair of calyx lobes to be larger than the inner three. This tendency is particularly strong in certain species of series *NITIDA*, as in *A. discolor*, in which the innermost segment may be entirely suppressed. The climax is reached in the species of *STEGOMERIA*, in which the two outer lobes become connivent for about half their length (except in *A. illustre*) and completely enclose the two inner lobes which are much smaller and are free. This very unusual calyx prompted me some years ago to erect a distinct genus, *Cufodontia*, for the single species then known (*C. stegomeris* Woods.). Discovery of the fruit of *Cufodontia* and appreciation of the tendency to zygomorphy of the calyx in many *Aspidospermas* renders the genus untenable in my opinion.

The corolla of *Aspidosperma* is of two general types: salverform with reflexed limb and tube constricted at the orifice as in series *MACROCARPA*, *RAMIFLORA*, and *PYRICOLLA*, and tubular or tubular-salverform with erect or laxly ascending limb respectively, and unconstricted tube, as in the remaining series save one. The most specialized of the latter type are found in series *NOBILES*. Here, with the exception of *A. Fendleri*, the lobes are abruptly caudate-acuminate and nearly filiform from near the base; they are very tightly contorted spirally in the bud, spreading horizontally as they unroll, and become erect at full anthesis. An intermediate type is found in *A. rigidum*, which comprises the series *RIGIDA*, in which the corolla lobes are reflexed, although the throat is not constricted.

A peculiar characteristic of the corolla which has been ignored generally is the series of longitudinal clefts or fissures which occur behind the stamens. These clefts originate as external invaginations of the corolla tube at the place of attachment of the epipetalous staminal filaments, eventually passing around the base of the filaments, as is shown diagrammatically in fig. 1; they may be reclosed almost immediately, or may continue some distance toward the corolla throat. Photomicrographs to illustrate the clefts in representative series are provided in pl. 1; these were prepared from microtome sections obtained from herbarium specimens, and tissue distortion caused by desiccation is apparent. Although I have found no verbal reference to the clefts, their use in dissections is shown by the very neat



drawings prepared both by Dr. Kuhlmann and by Sr. David de Azambuja, both of the Jardim Botânico of Rio de Janeiro.

The corolline clefts, in fact, seem to provide a rather precise morphological criterion to separate *Aspidosperma* from other closely related genera, for I have found them in all species of that genus, and quite absent in such relatives as *Microplumeria*, *Geissospermum*, and *Diplorhynchus*. A photomicrograph illustrating staminal insertion in *Diplorhynchus* is included in pl. 1. What the function of the corolline clefts of *Aspidosperma* may be is quite obscure to me: if the corollas were only larger, they might possibly be construed as "short cuts" for a pollinating proboscis, or even to drain excess water; but their very small size would appear to preclude these.

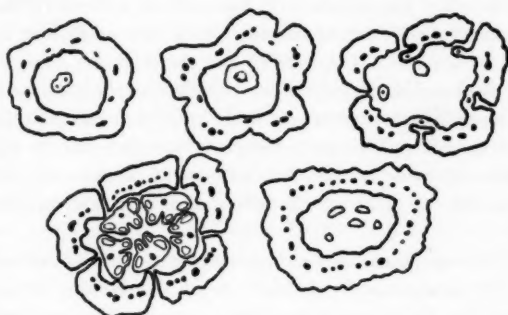


Fig. 1. Anatomy of the corolla in *Aspidosperma*: diagrams from serial microtome sections showing origin of the fissures. Explanation in the text.

Instead of functional innovations, it seems more likely that the epistaminal slits of *Aspidosperma* actually may be an atavism. In his study of the development of the perianth in *Vinca* [*Lochnera*] *rosea*, Boke<sup>1</sup> found that the upper corolla tube (i. e. above the insertion of the stamens) is formed by the ontogenetic union of the bases of the "petals", with the united epidermal layers remaining distinct as late as the organization of the staminal archesporium although lost at maturity.

Subtle differences of texture of the corolla of *Aspidosperma* have been quite noticeable to me, but I have found them difficult to convey to others and have omitted them from my keys. In the species of *MACROCARPA* and *RAMIFLORA* the texture appears rather thickly membranaceous, and more delicately so in *PYRICOLLA* and *STEGOMERIA*; dried corollas of these series imbibe water very freely and section in paraffin very readily, as the photomicrographs of pl. 1 show. In *NOBILES*, *NITIDA*, *QUEBRACHINES*, and most *POLYNEURA*, on the other hand, the texture appears to be subcoriaceous or at least pergamentaceous; corollas of *NITIDA* contain many cells packed with tannin and crystalline inclusions, and those of *NOBILES* are heavily suberized: this renders them very much more difficult to section, as the photomicrographs also testify.

<sup>1</sup>Boke, N. H. Amer. Jour. Bot. 35:413. 1948.

The stamens of *Aspidosperma* consist of two bilocular thecae which are wholly fertile to the base and free from the stigmatic clavuncle, as in most other Plumeroideae. The outer locule of either theca is slightly longer than the inner, under the base of which it tends to incurve. This tendency varies amongst the species and I have tried to use it as a supporting character for the series, but without success. The pollen is granular.

The stamens of the genus may be uniform amongst themselves or more or less dissimilar in size of anther and length and relative height of insertion within the corolla tube. This tendency is rather more marked and variable in the *NIITDA* than in the other series. Here, too, the tendency does not appear to be of sufficient uniformity to use as a "key character" even for the *NIITDA*.

Botanists who follow the literature of Apocynaceae will notice that my description of the thecae of *Aspidosperma* coincides with that of Pichon (in Mem. Mus. Nat. Hist. Nat. n. s. 27:183, 196. 1948) for the African genus *Diplorhynchus*: Pichon, in fact, distinguishes *Aspidosperma* and *Diplorhynchus* upon the characters of "anthères à sacs polliniques égaux . . ." and "anthères à sacs polliniques extérieurs dépassant les intérieurs . . .", in part, respectively. However, it will become apparent to any one carefully examining a series of dissections that the pollen sacs of *Aspidosperma* are far from equal, and accord with Pichon's description for *Diplorhynchus*.

Although I have specimens of only one species of *Diplorhynchus* available for study, namely *D. condylocarpon* (Muell. Arg.) M. Pichon, I have found the staminal filaments to bear a small laminate appendage at their insertion to the corolla tube, these resembling the filament appendages of my subgenus *Pteranthera* of the South American genus *Forsteronia* which are borne higher on the filament. Pichon does not mention these appendages, if indeed they occur in the other species of *Diplorhynchus*, but perhaps his description of the filaments as keeled ("carénés") may be intended to refer to them somewhat obliquely.

The pistil always is bicarpellary and the ovaries are free essentially from the receptacle to the common style, or somewhat united at the base. The ovules are peltate and borne upon a binate ventral placenta, the number of rows upon each placenta-half varying from one to six. In *POLYNEURA* the number of ovules is characteristically smaller than in the other series, being reduced to two in *A. dispermum*.

The stigmatic clavuncle is relatively simple and small, and from capitate to fusiform in shape (occasionally somewhat umbraculiform) and bluntly or sharply apiculate. It has not appeared sufficiently useful to be employed systematically.

It has become habitual to describe the pistil of *Aspidosperma* as possessing an annular nectary or "discus", and amongst such authors I must include myself (in N. Amer. Flora 29<sup>2</sup>:119. 1938). It is true that in *A. macrocarpon* the outer wall of the ovary is irregularly tumid and glandular toward the base, and that this region certainly represents a strongly adnate nectary; but in the remaining species

even such evidence of a nectary is wholly lacking. It surely is indicative of the prevalent ignorance of the genus that so many authors, including myself, have actually distinguished *Aspidosperma* from related genera by invoking this essentially imaginary structure whose rather variable appearance in one or two species certainly is of phylogenetic rather than of diagnostic importance.

*Fruit.*—The fruit of *Aspidosperma* is a dry, dehiscent, more or less woody follicle containing few or numerous, large, papery-winged seeds from which the generic name is derived. The follicles are strongly compressed, as a rule, but may be nearly cylindric normally, as in *A. cylindrocarpon*, or as apparently individual or racial anomalies in such species as *A. quebracho-blanco*. The size varies greatly, the smallest (2–4 cm. long) in *A. dispernum* and *A. cuspa* of the POLYNEURA, and the largest (9–15 cm. long) in *A. macrocarpon* and *A. verbascifolium* of the MACROCARPA.

The shape of the follicle generally is broadly rounded and may be seen to consist of several types as expressed roughly in degrees of curvature of the placental margin, which always occupies the greater arc. The shape is simplest in the NOBILES, where the margins are more or less equally biconvex with resultant elliptical or circular configuration: the placenta may be described in this series as rotating about  $120^{\circ}$ – $180^{\circ}$ . In the series NITIDA and STEGOMERIA the follicle is nearly circular for quite another reason, for the placental margin may rotate as much as  $300^{\circ}$  and the shape is more accurately defined as very unequally convex-concave or convex-plane and very broadly dolabriform. In all three of these series the seeds are nearly circular with the embryo more or less central.

In MACROCARPA and particularly in PYRICOLLA the follicle is pyriform and unequally biconvex with the placental margin the greater ( $180^{\circ}$ – $225^{\circ}$ ), and gradually attenuated to a basal stipe. Although the seeds of MACROCARPA are nearly circular, those of PYRICOLLA are ovate and acute at the base. In POLYMERIA (except *A. dispernum*) the follicles are falciform to clavate-subcylindric and the seeds are very distinctive, bearing a much reduced basal wing quite excentric to the embryo; this tendency is climaxed in *A. cuspa*, in which the cotyledons are asymmetric as well, with one cordate lobe shorter than the other. In *A. cuspa*, also, the wings of the seed appear as alternately basal and apical as seen in the opened follicle, although all are chalazal, and therefore basal as determined by the position of the embryo: these fruits correspond almost exactly to those of the African genus *Diplorhynchus*.

Additional useful characters of the fruits of *Aspidosperma* are found in the relative development or suppression of a basal stipe, the presence or absence of obvious lenticels, quality or absence of indument, etc. Particularly useful in the recognition of species of the NITIDA are the warty or spiny excrescences of the pericarp.

## PHYLOGENY OF THE SERIES

Pichon's synopsis of *Aspidosperma* (in Bull. Mus. Nat. d'Hist. Nat. ser. 2, 19:362. 1947) is based almost entirely on relative dimensions of the corolla tube and lobes, and results in the erection of 12 major divisions which he called "series," but the names of which are constructed as recommended for sections by the International Rules and which furthermore are preceded by the sign (§) ordinarily reserved to designate sections. I am referring to these categories as sections in this discussion. Two of Pichon's sections consist of species which I am excluding from *Aspidosperma*; otherwise, the enumeration of his sections are as provided below, each preceded by an alphabetical index for use in our further discussion:

- |                 |                |
|-----------------|----------------|
| (a) TETRASTICHA | (f) LAEVIFOLIA |
| (b) GLABRIFLORA | (g) MICROLOBA  |
| (c) PILIFLORA   | (h) RETICULATA |
| (d) MACROLOBA   | (i) CRASSITUBA |
| (e) MACRANTHA   | (j) PUNGENTIA  |

My own major divisions coincide with the sections of Pichon essentially only where Pichon's are not based upon relative dimensions of the corolla tube and lobe (i. e. in his sections CRASSITUBA, PUNGENTIA, and in part RETICULATA). This is my major reason for adopting an entirely different nomenclature as being less liable to confusion with his. Whether an intrageneric group is to be designated as a section or as a series, of course, is not entirely a matter of convenience however weighty that argument may be; in addition, my groups, although I believe them to be quite natural, lack the distinction which I should prefer sections to have. The tendencies themselves may well lead in time to the definition of fully formed genera in fact, but at the present time they are too fluid. At any rate, my series are as follows. For sake of contrast with Pichon's sections, I have appended to the name of my series a sequence of letters to stand for Pichon's placement of species with reference to the enumeration of his series in the preceding paragraph. The actual names of the species would make the list too cumbersome.

- |   |                                  |
|---|----------------------------------|
| (1) MACROCARPA—c, c <sub>0</sub>  | (6) NITIDA—c, e, f <sub>12</sub> |
| (2) RAMIFLORA—e   | (7) STEGOMERIA—e                 |
| (3) PYRICOLLA—a, b <sub>2</sub> , c <sub>7</sub> , d <sub>3</sub> , e, f, g <sub>12</sub> | (8) QUEBRACHINES—j <sub>2</sub>  |
| (4) POLYNEURA— <sub>a</sub> <sub>2</sub> , b, d, h <sub>11</sub>                          | (9) NOBILES—i <sub>12</sub>      |
| (5) RIGIDA—a, b, c  |                                  |

Without attempting a mathematical analysis, the degree of correlation may be envisaged by means of a scatter diagram (text-fig. 2).

For many years I have looked forward to the opportunity of comparing two independent taxonomic studies, such as this. The opportunity is greater yet, since there exists a recent "monograph" of *Aspidosperma* by Milanez (in Physis 15:429. 1939) which is based upon wood anatomy instead of organography. Milanez was able to examine material of 29 species of *Aspidosperma* (a thirtieth, *A. quadri-*

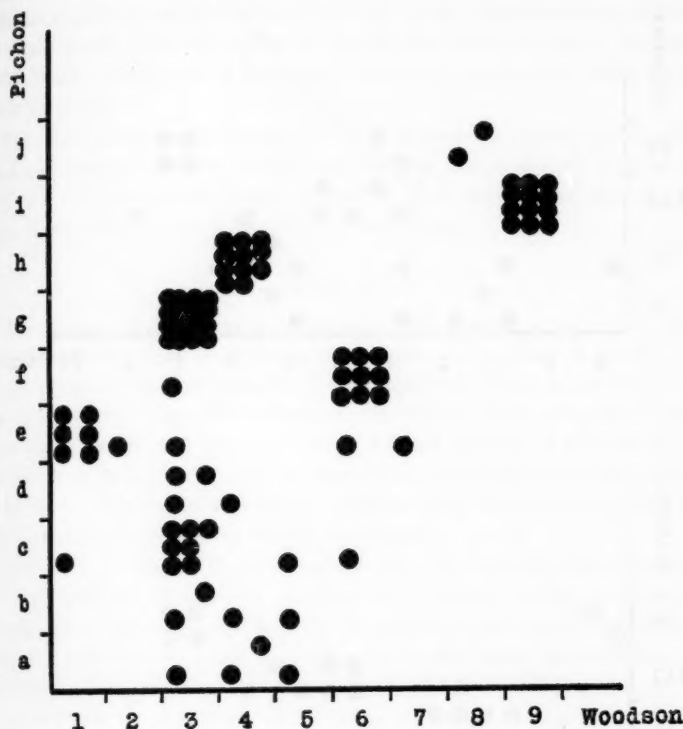


Fig. 2. Correlation of Pichon's sections and Woodson's series of *Aspidosperma*. Explanation in the text.

*ovulatum* Pittier, actually being a species of *Rauwolfia* and is excluded from this discussion). As a result of his investigations Milanez was able to distinguish four "sections" based upon the position of the wood parenchyma: whether terminal, diffuse, metatracheal, or paratracheal, representing what he believed to be a phylogenetic sequence following Jeffrey. An interesting contrast of Pichon's system and my own is obtained by regression of either upon that of Milanez, whose sections are indicated by Roman numerals consecutively in the appended scatter diagrams (text-fig. 3).

MILANEZ' SYSTEM / PICHON'S

- I.  $c_2, d, e, g_2$
- II.  $a, c, e, g_2, h_4$
- III.  $e_2, f_3, h, j$
- IV.  $e_2, i_4$

MILANEZ' SYSTEM / WOODSON'S

- I. 1, 3<sub>5</sub>
- II. 2, 3<sub>4</sub>, 4<sub>4</sub>
- III. 4, 6<sub>4</sub>, 7<sub>2</sub>, 8
- IV. 1<sub>2</sub>, 9<sub>4</sub>

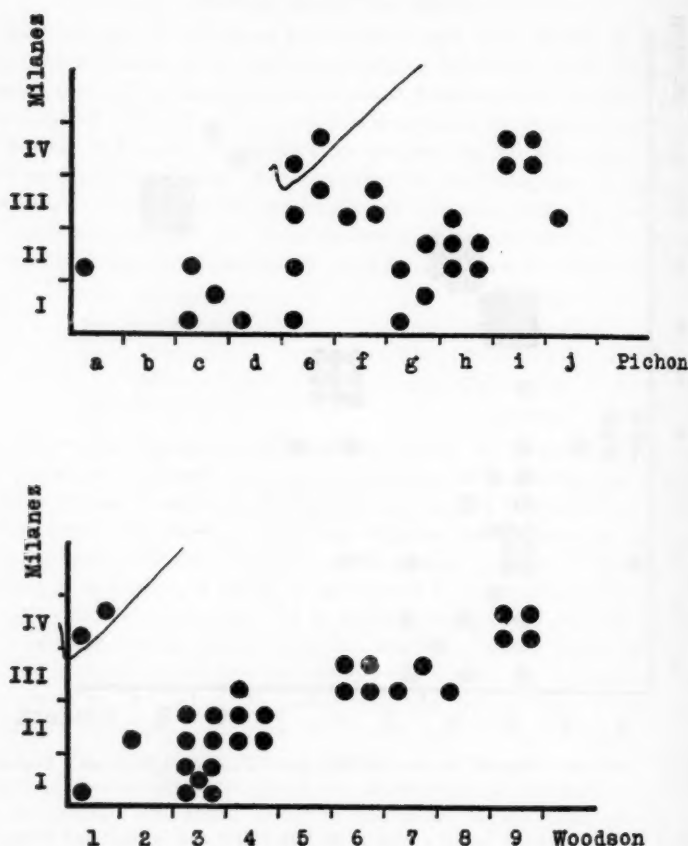


Fig. 3. Comparison of Milanez' system of *Aspidosperma* with those of Pichon and Woodson, respectively. Explanation in the text.

It will be noticed that Pichon's system and mine agree in one very important detail, and that is lack of agreement with Milanez in the disposition of two of his species in Section IV. These species are cited by him as "*A. LeCointei*" and *A. Duckei*. The first is cited in 'Index Kewensis' as a typographical error for the second! It appears almost certain that the material which Milanez studied was misdetermined. Since it apparently was a large-flowered species, upon the basis of our very close agreement, I suspect that his trees may actually have been of one of the large-flowered species of my series *NITIDA* (VI), which bear a superficial



resemblance to those of my *MACROCARPA* (I). I have tried to locate herbarium specimens to accompany Milanez' wood samples, both at the Yale School of Forestry and at the Jardim Botânico of Rio de Janeiro, but without success. In view of their dubious identification, I have drawn a line to separate their scores upon the scatter diagrams.

The reticulate nature of phylogeny and the barriers to adequate serial presentation are so familiar to every evolutionary biologist that it scarcely is necessary to point out that perfect correlation of two or more independent systems of any group of organisms is almost impossible of fulfillment.

#### SPECIATION

The persistent doubt in the minds of some well-informed persons, even amongst biologists, whether, upon describing a new species, a systematist is describing only a single organism (his type specimen) or a population, never ceases to amaze me. One would suppose it beyond the limits of profitable discussion to question whether, in erecting a species even upon the basis of a single specimen, a systematist visualizes himself as expressing at least the approximate mode of a population frequency distribution. This should be evident in the invariable expression "*species nova*", since a species is a concept of natural populations.

Undeniably it happens all too frequently that a type specimen of an author may be found later not to represent the mode of a distinct natural population but actually, say, a certain quartile or decile (or whatever) of a frequency distribution previously envisaged by another author: his species name thereupon becomes a synonym of the aggregate. This, essentially, is the function of monographic study, i.e. to establish the frequency distributions of natural populations and also to assign the relative position of previous population concepts within those distributions.

In 1936 R. A. Fisher (in *Ann. Eugenics* 7:179. 1936) published his process of "discriminate functions" by which it is possible to demonstrate mathematically the reality of two or more natural populations. There can be little doubt that in defining his systematic categories a systematist operates in a closely analogous manner more or less subconsciously, by seeking the ratio of the difference between the means of a compound measurement to its standard error. This, of course, is what we mean by the need of a systematist for experience and judgment: experience in the degrees of variance of the organisms which he studies, and judgment of their values relative to others. I am convinced that the contours of the normal distribution are quite as deeply impressed in the minds of the best of our systematists as they are amongst statisticians in general. The lot of the systematist, however, deserves the sympathetic commiseration of all professional statisticians because of his usual lack of linear series and the general paucity of his samples.

Adequate samples are as desirable to a systematist as to a mathematical statistician. But whilst a mathematician would seldom attempt to find a frequency distribution from a single case, a systematist is called upon to do so quite regularly: he seeks to do this approximately by extrapolation from his experience with other related organisms: systematic biology would as surely be thrown into confusion if he did not do so, as mathematics would be if mathematicians were to follow suit.

I have found Du Rietz's definition of taxonomic categories (in *Svensk Bot. Tidskr.* 24, H. 3:333. 1930) very stimulating and helpful, although certainly idealistic and occasionally difficult to satisfy in many problems. As we have noticed already, an experienced taxonomist usually will be able to distinguish a species from a single specimen. In the case of a subspecies this usually will be impossible, if we are to keep the subspecies in its geographic or ecologic connotation which I feel to be a *sine qua non*. I personally can see little value in the concept of variety as a non-geographic or non-ecologic variant: perhaps it might be used as a provisional status where the habitat factor is yet to be demonstrated fully. I have not considered my present data sufficient to warrant the establishment of infra-specific categories in *Aspidosperma*.

Nowadays the imaginations of plant systematists may be somewhat overstimulated in the detection of hybrids; but in *Aspidosperma* it appears to me that there are two very obvious instances of it: perhaps the simpler case occurs in northeastern South America. There are three species of the series NOBILES: *Aspidosperma album*, *A. Spruceanum*, and *A. Fendleri*. The first is the most widespread, ranging from the Magdalena River in Colombia to the lower Amazon in Brazil. It has very distinctive inflorescence structure of a peculiar scorpioid aspect, and narrowly stipitate follicles which are almost exactly circular in outline and with a relatively thin, minutely yellowish-pulverulent pericarp; the leaves of specimens to the extreme north and south of its distribution are wholly or essentially glabrous. Both *A. Spruceanum* and *A. Fendleri* have corymbiform inflorescences, leaves which are white-tomentulose beneath, and much more woody follicles which are sessile or very shortly stipitate; the former is found in the upper Amazon and Rio Negro basins, and the latter in Venezuela. The two species have several differentia, but the chief is found in the corolla lobes: whether narrowly caudate-acuminate and tightly spiral in the bud (*A. Spruceanum*), or rather broadly ovate and acute, and scarcely spiral in the bud (*A. Fendleri*).

It so happens that in much of the Guianas, Venezuela, and the middle Amazon, many specimens with inflorescences and pods characteristic of *A. album* are found with leaves more or less white-tomentulose beneath (such, in fact, are the type specimens not only of *A. album* but of all its synonyms—the populations which I consider as genetically most pure are without separate nomenclatural designation), or again, with inflorescences midway between scorpioid and corymbiform, or, yet again, with woody, sessile follicles with the indument as for *A. album*. It seems more than likely that such variation, in the light of the specific characters of the geographically neighboring species, may be taken as evidence, *in herbario* (!), of

hybridization. That *album* is involved is very apparent; whether both *Spruceanum* and *Fendleri* are involved as well, or only the former, is not so clear—but all of the putative hybrids collected in flower show the attenuate and tightly rolled corolla lobes, so that I am inclined to think the former the more likely complementary parent if but one is to be selected.

No less than ten species names have been proposed in the past to describe individual variants of the populations of which I speak, and each one could be represented in a key which might be adequate to distinguish the specimens presently at hand but which would cause increasing difficulty as each additional specimen accrued to our collections. This would be natural to expect as the result of random segregation of multiple factors in two or more interbreeding populations. Since these species of *Aspidosperma* occupy rather distinct geographical ranges, the genetic intergrades may be found to compose a geographical gradient or genocline.

In a well-known floristic region, such as the eastern United States, it might be possible, with hundreds or thousands of herbarium specimens, extensive field observation, and by dint of several years of exhaustive study, to establish the contours of such a genocline if such it is. Contemporary systematic botany cannot wait for such minutiae for many genera and species, quite obviously. Unless utter chaos is to result, the major emphasis of plant systematists must continue to be spent on the "exploratory" phase, guided by more occasional excursions into the "experimental" phases; until, in fact, there is nothing left to "explore", and that will not be for some time to come.

If I knew as much about each of the 52 species of *Aspidosperma* as I do about two of the subspecies of *Asclepias tuberosa* after six precious years of study (cf. Ann. Missouri Bot. Gard. 34:353. 1947), or as Professor Babcock knows about *Crepis* after almost a lifetime of study, I might map the various clines with considerable precision. Then I might be able to designate a certain specimen, for instance, as "*Aspidosperma album*  $\times$  *Spruceanum* ( $F_1$ )", or go into detail if a backcross. As it is, some complicated backcrosses are apt to appear pretty homozygous to me; what am I to do?

I believe that, as a systematic "explorer", what should be done is to construct my keys to species elastically enough to include genetic variants with the species most cognate to them, even at the expense of verbal contrast, giving warning in a footnote if hybridization is suspect. I should consider myself insincere to attempt unreserved specific segregations if the slightest evidence of hybridization (or areal or ecological clines) were manifest. That has been my guide in this study of *Aspidosperma*, which probably recognizes fewer species than some readers will expect. My chief fear is that there still may be too many.

At the other end of South America, in the *campos* of southern Brazil and adjacent Paraguay, Argentina, and Bolivia, a fascinating pattern of variation, possibly the result of multiple-factor recombination following hybridization, is found to connect no less than four species of series PYRICOLLA: *A. tomentosum*, *A. australe*, *A. subincanum*, and *A. parvifolium*. These species all inhabit the same

general range, and all are represented in our herbaria by copious specimens in which the various characters of habit, type of bark, size and shape of leaf and flower, and particularly peculiar indument are strongly and positively correlated.

These are the most frequently collected of *Aspidospermas*, and amongst the several scores of specimens in our museums there are sufficient to testify to the absence of absolute pollination and genetic barriers between them. The species, *per se*, are so distinctive that a tremendous range of recombination patterns is produced, and these are well represented in the specimens cited in the following taxonomic section. I have attempted to arrange the specimens into eight groups as a very rough estimate of this putative hybridization:

GROUP I. ("Pure" *tomentosum*): Thick, heavily corky stems; large sessile leaves; long corolla lobes; inflorescence very condensed; follicles without a definite midrib—all very densely yellow-tomentose.

GROUP II. ("Pure" *australe*): Slender stems with thin bark at least on upper branches; smaller, long-petiolate, glabrous leaves; short corolla lobes; inflorescence diffuse; follicles without a definite midrib or indefinitely striate.

GROUP III. ("Pure" *subincanum*): Slender stems with thin bark; rather large, sessile leaves finely white-sericeous beneath and glabrous above; intermediate corolla lobes; inflorescence diffuse; follicles with a prominent midrib.

GROUP IV. ("Pure" *parvifolium*): Slender stems with thin bark; small, moderately petiolate leaves; short corolla lobes; inflorescence few-flowered; follicles with a very prominent midrib—all densely reddish-tomentellous.

GROUP V. (*Gomezianum*, etc.): Rather slender, thinly rimose stems; rather large, sessile or short-petiolate leaves nearly or quite glabrous; intermediate corolla lobes; inflorescence much branched from the base, finely puberulent; glabrous follicles without definite midrib. (*tomentosum*  $\times$  *australe*?).

GROUP VI. (*Chodatii*): More slender, thinly rimose stems; large, long-petiolate leaves finely canescent to glabrate; long corolla lobes; inflorescence fairly long-pedunculate, finely puberulent to glabrate; follicles with a prominently elevated midrib. (*tomentosum*  $\times$  *subincanum*?).

GROUP VII. (*camporum*, *Warmingii*, etc.): More slender, thinly rimose stems; small or medium-sized, short-petiolate leaves; shorter corolla lobes; shortly pedunculate inflorescences—all very densely orange-tomentellous; follicles with a prominent midrib. (*tomentosum*  $\times$  *parvifolium*?). It seems significant that this group is found in the southern coastal Brazilian states.

GROUP VIII. (various backcrosses to *tomentosum*?): Much as in Group I, but stems somewhat more slender and with less corky bark.

The enumeration of such groups could be subdivided almost indefinitely to indicate accessory hybridizations particularly of *australe* with closely neighboring

species (*vide infra*). The collections which my friend Senhor Amaro Macedo has sent me for study are helpful in this connection, since he has found trees of four of these groups, I, VI, VII, and VIII, within a single day's collecting in the vicinity of Ituiutaba, Minas Gerais. I hope that this problem will not escape the attention of Brazilian botanists who are interested in natural hybridization in their rich flora.

Another type of difficulty is represented in series PYRICOLLA by the group of species comprising *A. australe*, *A. pyricollum*, *A. Ulei*, and *A. Vargasii*, enumerated in their approximate geographic sequence from south to north in eastern South America. As reference to the key to species will show, the morphological criteria characterizing these species are of a somewhat different character, and are generally more difficult to analyze than is true in the genus as a whole.

They are capable of recognition, however, and the rather unsatisfactory morphological differentia appear to be reinforced by distinctive geographical ranges. Hybridization also may appear to be the agency in producing morphological blurring at the boundaries of the ranges. Such being the case, I suspect that the units which I am designating as closely knit species may, upon more adequate materials for study, prove to be geographic subspecies. I hesitate to change their presently accepted status because my rather paradoxical feeling is that the recognition of subspecies requires more detailed study than for species! But I believe that this viewpoint is easily defensible.

A knotty problem of nomenclature which will have to be tackled sooner or later concerns type specimens which are shown to be heterozygous. An instance in point is the type specimen of *Aspidosperma album* (Richard s. n. in Herb. Haun.), which has the peculiar inflorescence and leaf outline of supposedly homozygous *A. album* as defined in this paper, but with the leaves white-tomentulose beneath as in *A. Spruceanum*. Should a "neotype" be selected from the homozygous populations and the historical holotype disqualified as heterozygous? Opinion may sanction that at length, but I believe that few contemporary botanists would allow a policy so gravid with confusion; for type specimens of incalculable number would be subject to change from the time of Linnaeus. The inference which I draw is that type specimens will be but of casual interest, once the "exploratory" period of plant systematics is ended; until then, our "higher criticism" of them must be held in check.

#### ECONOMIC USES AND VERNACULAR NAMES

Notes on the economic uses of *Aspidosperma* as reported by plant collectors are scattered throughout the following text, under the appropriate species. Detailed information on the timbers of various species will be found in Record & Hess, "Timbers of the New World", pp. 107-115 (Yale University Press, 1943).

The trees are so familiar to the local inhabitants that vernacular names are legion. These are noted for each species, when reported by collectors of the specimens cited, and are gathered together in a special index preceding the taxonomic index.



## STUDY MATERIAL

I have been privileged to study herbarium specimens from the following institutions, to the curators of which I am greatly indebted. I have used the symbols advocated by Lanjouw (in Chron. Bot. 5:143. 1939) in citing the specimens:

- C—Botanisk Museum, Copenhagen.
- F—Chicago Natural History [formerly Field] Museum, Chicago.
- G—Conservatoire Botanique, Geneva.
- GH—Gray Herbarium, Cambridge, Mass.
- K—Royal Botanic Gardens, Kew.
- MO—Missouri Botanical Garden, St. Louis.
- NY—New York Botanical Garden.
- P—Muséum National d'Histoire Naturelle, Paris.
- S—Naturhistoriska Riksmuseet, Stockholm.
- US—U. S. National Herbarium, Washington.
- U—Botanisch Museum en Herbarium, Utrecht.
- W—Naturhistorisches Museum, Vienna.
- COL—Instituto de Ciencias Naturales, Bogotá.
- R—Museu Nacional, Rio de Janeiro.

## TAXONOMY

ASPIDOSPERMA Mart. & Zucc. in Mart. Nov. Gen. & Sp. 1:57. 1824; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:362. 1947, *nom. conserv.* (T.: *A. tomentosum* Mart.).

*Macaglia* Rich. ex Vahl, in Skrivt. Nat. Selsk. Kjoebenh. 6:107. 1810. (T.: *M. alba* Vahl).

*Peltospermum* DC. in Bibl. Univ. Genève 17:133. 1838. (T.: *P. Patrisii* DC.).

*Ostreocarpus* Rich. ex Endl. Gen. Pl. 1396. 1840, *nom. nud. in synon.*

*Thyroma* Miers, Apoc. So. Am. 22. 1878. (T.: *Tb. sessiliflora* (Muell. Arg.) Miers).

*Cufodontia* Woodson, in Archivio Bot. Sist. Fitogeogr. & Genet. 10:39. 1934. (T.: *C. stegomeris* Woodson).

*Coutinia* Vell. Quinogr. Portug. 166, pl. 10. 1799. (T.: *C. illustris* Vell.).

Trees, rarely shrubby, usually with milky or reddish latex. Leaves usually alternate or approximate, rarely decussate or ternate, stipulate, penninerved. Inflorescence terminal or axillary, occasionally extra-axillary, determinate, dichasially cymose (frequently with the determinate flower suppressed) to aggregate-dichasial and thyrsiform, the secondary peduncles frequently fasciculate in umbelliform manner, bracts persistent, caducous, or suppressed; calyx usually of 5 free, equal to strongly unequal lobes, rarely 4 with the 2 outermost larger and strongly connate with the 2 inner and free lobes wholly included, always eglandular within; corolla salverform to tubular-salverform or tubular, the tube cylindrical to ampuliform and constricted or not constricted at the orifice, fissured behind the anthers, the lobes sinistrorsely contorted in aestivation, reflexed to erect in anthesis; stamens inserted midway or higher within the corolla tube, filamented, the anthers minutely mucronulate, of 2 uniformly fertile thecae, each 2-loculate, the outer locus somewhat longer than the inner and usually somewhat inflexed at the base, the pollen



granular; pistil superior, 2-carpellate, the carpels essentially free from the style to the receptacle, sometimes apparently glandular toward the base but without a distinct disc, bearing 2–32 peltate 2–6-seriate ovules upon a thin ventral placenta, the stigma variously clavate to subcapitate upon a more or less elongate common style. Fruit follicular, usually strongly compressed and more or less woody, more or less asymmetrical from nearly circular to falciform or dolabriform, the seeds peltate, exalbuminous, greatly compressed, with a flat, papery, concentric or strongly excentric wing.

## KEY TO THE SERIES

- a. Corolla typically salverform, the lobes reflexed or horizontally spreading, the tube constricted at the orifice; bracts wholly suppressed (except in *A. ramiflorum*).
- b. Corolla 1.2–2.5 cm. long, of relatively thick texture.
  - c. Inflorescence terminal or subterminal, pedunculate; follicles broadly dolabriform, subplano-convex, the placenta rotating about  $225^{\circ}$ , gradually narrowed to a conspicuous stipe, minutely papillate to essentially glabrous, without obvious lenticels, unusually large; seeds with a nearly circular concentric wing..... I. MACROCARPA (p. 138)
  - cc. Inflorescence cauliflorous, sessile; follicles broadly dolabriform, plano-convex, the placenta rotating about  $270^{\circ}$ , sessile, minutely papillate to essentially glabrous, very conspicuously lenticellate, moderately large; seeds with a nearly circular concentric wing..... II. RAMIFLORA (p. 142)
  - bb. Corolla 0.4–0.8 cm. long, or if longer (*A. pyrifolium*) of delicate texture; follicles pyriform, unequally bi-convex, the placenta rotating about  $180^{\circ}$ , gradually narrowed to a conspicuous stipe, minutely papillate to essentially glabrous (densely yellow-tomentose in *A. tomentosum*), conspicuously lenticellate; seeds with a concentric, ovate wing acute at the base..... III. PYRICOLLA (p. 144)
12. Corolla tubular or tubular-salverform, the lobes erect or slightly spreading at anthesis (salverform with reflexed lobes in *A. rigidum*), the tube not constricted at the orifice; bracts usually manifest and persistent, occasionally wanting (caducous in QUEBRACHINES).
  - b. Corolla tube essentially terete, the lobes not abruptly caudate-acuminate, erect or loosely spiral in the bud; inflorescence neither whorled nor fastigiate.
  - c. Leaves alternate or irregularly approximate, not spine-tipped.
  - d. Calyx lobes 5, abnormally 4, distinct or barely united at the base, equal to more or less unequal.
  - e. Corolla glabrous without (occasionally velutinous-papillate toward the tip in POLYNEURA).
    - f. Corolla tubular or tubular-salverform, the lobes erect or slightly spreading; ovary essentially terete; follicles falciform to subcylindric, somewhat concave- to somewhat bi-convex, the placenta rotating about  $45^{\circ}$ – $135^{\circ}$ , sessile, essentially glabrous, conspicuously lenticellate; seeds with a narrow, strongly eccentric basal wing (except in *A. dispernum*)..... IV. POLYNEURA (p. 157)
    - ff. Corolla salverform, the lobes reflexed at anthesis; ovary polygonally angulate; follicles very broadly dolabriform, concave-convex, the placenta rotating about  $300^{\circ}$ , smooth, with or without a midrib, sessile; seeds with a concentric circular wing..... V. RIGIDA (p. 164)
  - ee. Corolla densely sericeous without; ovary polygonally angulate or sulcate; follicles very broadly dolabriform, concave-convex to very unequally bi-convex, the placenta rotating about  $225^{\circ}$ – $300^{\circ}$ , warty or spiny, sessile or very abruptly and shortly stipitate; seeds with a concentric circular wing..... VI. NITIDA (p. 166)

- dd. Calyx lobes 4, abnormally 5, the outer pair much larger and strongly connate (except in *A. illustre*), completely including the inner pair which are separate and much smaller; follicles very broadly dolabriform, plano- to concave-convex, the placenta rotating about  $275^{\circ}$ – $300^{\circ}$ , sessile or shortly stipitate, with a loose, wrinkled, more or less lenticellate periderm; seeds with a concentric circular wing.....
- cc. Leaves opposite or ternate, spine-tipped; follicles broadly oval to subcylindric, almost equally bi-convex, the placenta rotating about  $45^{\circ}$ – $135^{\circ}$ , minutely papillate to essentially glabrous, obviously lenticellate, sessile or very shortly stipitate (*A. borco-quebracho*); seeds with a nearly circular concentric wing.....
- bb. Corolla tube strongly callose-angulate, the lobes strongly caudate-acuminate and very tightly spiral-contorted in the bud (except in *A. Fendleri*); primary branches of the inflorescence usually whorled or fastigiate; follicles somewhat pyriform to nearly circular or subcylindric, almost equally bi-convex, the placenta rotating about  $120^{\circ}$ – $180^{\circ}$ , stipitate to sessile, densely tomentellous, not obviously lenticellate; seeds with a concentric, nearly circular wing.....

VII. STEGOMERIA (p. 176)

VIII. QUEBRACHINES (p. 180)

IX. NOBILES (p. 183)

## SERIES I. MACROCARPA Woodson, n. ser.

§ *Macrantha* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947, in part.

Trees with milky latex, apparently deciduous, with thick corky, or thin rimose bark, not conspicuously lenticellate. Branches with naked, rounded buds, the subtending internode definitely thicker than the terminal petiole, without definite seasonal articulations, but with internodes greatly shortened toward the tip of the branch. Leaves alternate, rather broad and subcoriaceous, with widely arcuate secondary veins reticulating distally and with apparent reticulate tertiary venation on the lower surface. Inflorescence terminal or subterminal, cymiform, without obvious bracts; corolla typically salverform, the lobes reflexed or horizontally spreading, the tube constricted at the orifice, relatively large and of thick texture, densely tomentose or tomentellous without. Follicles unusually large, broadly dolabriform, subplano-convex, the placenta rotating about  $225^{\circ}$ , gradually narrowed to a conspicuous stipe, minutely papillate to essentially glabrous, without obvious lenticels; seeds with a nearly circular, concentric wing.

*Species 1–2*

Figure 4.

## KEY TO THE SPECIES

- a. Flowering branches relatively slender, the internodes not greatly condensed, the periderm thin and rimose; leaves of moderate size, abruptly produced into rather slender petioles, inconspicuously pubescent to glabrous; corolla appressed-sericeous without, the tube conspicuously fissured..... 1. *A. MACROCARPON*
- aa. Flowering branches very stout, the internodes greatly condensed, the periderm very thick and suberose; leaves very large, decurrent to short stout petioles, densely tomentose to glabrate in age; corolla densely tomentose, the tube inconspicuously fissured..... 2. *A. VERBASCIFOLIUM*  
(*A. macrocarpum* and *A. verbascifolium* appear to hybridize freely)
1. *ASPIDOSPERMA MACROCARPON* Mart. Nov. Gen. & Sp. 1:59. 1824; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: *Martius s. n.*)
- Aspidosperma platyphyllum* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:46. 1860; M. Pichon, loc. cit. 1947. (T.: *St. Hilaire 844*).
- Aspidosperma macrocarpum* (sic!) Mart. a. *normale* Muell. Arg. loc. cit. 47. 1860. (*A. macrocarpum* Mart., var. *typ.*).

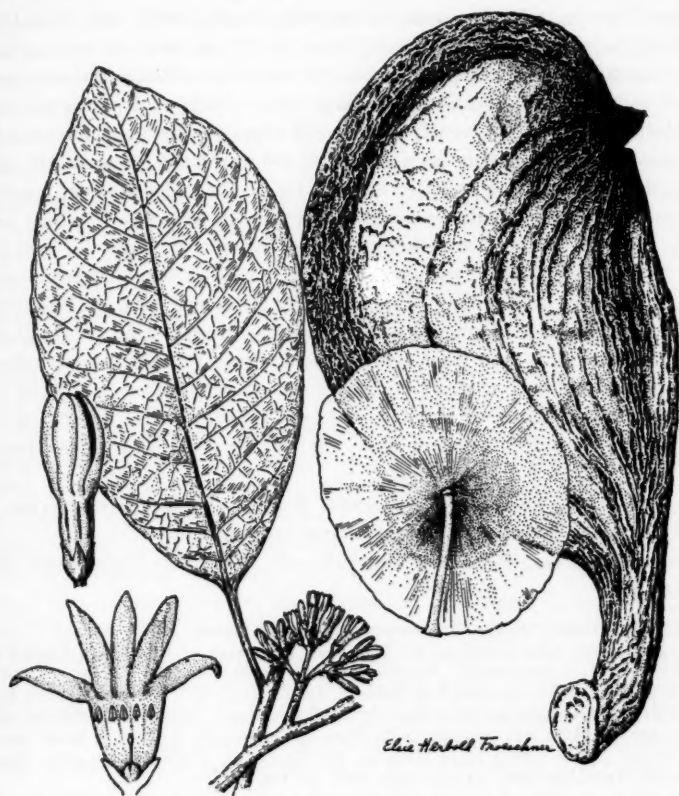


Fig. 4. *Aspidosperma macrocarpum* Mart.: Flowering branch, bud, dissected flower, fruit, and seed.

*Aspidosperma macrocarpum* Mart.  $\beta$ . *glabratum* Muell. Arg. loc. cit. 1860. (T.: Riedel 540).

*Aspidosperma macrocarpum* Mart.  $\gamma$ . *macrothyrsus* Muell. Arg. loc. cit. 1860. (T.: Riedel 2770).

*Aspidosperma macrocarpum* Mart.  $\delta$ . *lanatum* Muell. Arg. loc. cit. 1860. (T.: Riedel 475).

*Aspidosperma Gardneri* Muell. Arg. loc. cit. 1860; M. Pichon, loc. cit. 1947. (T.: Gardner 2666!).

*Aspidosperma Gardneri* Muell. Arg.  $\alpha$ . *ovatum* Muell. Arg. loc. cit. 48. 1860. (*A. Gardneri* var. typ.).

*Aspidosperma Gardneri* Muell. Arg.  $\beta$ . *ellipticum* Muell. Arg. loc. cit. 1860. (T.: Weddell 2470!).

*Macaglia platyphylla* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Macaglia macrocarpa* (Mart.) O. Ktze. loc. cit. 1891.

*Macaglia Gardneri* (Muell. Arg.) O. Ktze. loc. cit. 1891.

*Aspidosperma Duckei* Huber, in Archiv. Jard. Bot. Rio. Jan. 3:244. 1922. (T.: Ducke 11040!).

*Aspidosperma Snetblagei* Mg. in Notizbl. 10:118. 1927. (T.: Snetblage 676!).

*Aspidosperma LeCointei* auct. ex Record, apud Milanez, in Physis 15:479. 1939.

Trees 3–25 m. tall, the branches relatively slender, with thin, rimose bark. Leaves elliptic, obtuse at base and apex, about 10–17 cm. long and 5–8 cm. broad, firmly membranaceous, wholly glabrous to variously yellow-pubescent; petioles about 1–4 cm. long. Inflorescences clustered subterminally at the uppermost nodes, subumbelliform, several-flowered, densely and minutely ferruginous-tomentellous to yellow-tomentose; primary peduncle about 1–3 cm. long, the secondary peduncles obsolete or nearly so; pedicels 1–2 mm. long. Calyx lobes ovate, acuminate, 2–4 mm. long, nearly equal, appressed-tomentellous to tomentose. Corolla white, densely appressed-sericeous to yellow-tomentose without, the tube 6–7 mm. long, about 2 mm. in diameter at the insertion of the stamens, somewhat constricted at the base and at the orifice, deeply fissured, nearly glabrous within, the lobes oblong-elliptic, 7–9 mm. long. Stamens inserted at about midway within the corolla tube, the anthers about 1.5 mm. long. Ovary ovoid, about 1.5 mm. long, wholly glabrous or tomentellous; stigma narrowly ovoid to subfusiform. Follicles semi-circular or dolabriform, 9–14 cm. long, 8–12 cm. broad, the stipe about 3 cm. long, very stout, pericarp dark brown to black, irregularly striate, minutely tomentellous; seeds circular, about 8 cm. in diameter.

Central Brazil and adjacent Venezuela, Bolivia, and Paraguay; savannas and gallery forests; flowering chiefly from August until September.

Vernacular names: *Platanote* (Venezuela—Ll. Williams); *Muirajussára* (Brazil—A. Ducke).

VENEZUELA: AMAZONAS: El Ratón, alt. 100 m., Williams 13223 (F).

BRAZIL: ACRE: near mouth of Rio Macauhan (tributary of Rio Yaco), Krukoff 5682 (K, MO, U, US). AMAZONAS: Parintins, Ducke 24574 (K, US). GOIAZ: Riedel s. n. (GH, W), 2770 (U). MARANHÃO: Grajahú, Lisboa 2344 (US). MATO GROSSO: Kuntze s. n. (NY). MINAS GERAIS: St.-Hilaire 1770 (P). PARA: Obidos, Ducke 11040 (G, P, US), 11402 (K, U); Rio Tapajóz, Bella Vista, Ducke 16489 (G, US); haut Ariramba (Trombetas), Ducke 14889 (G); bords du Rio Tocantins, Weddell 2470 (P). PIAUHY: S. Filomena, Smetblage 676 (F); Gardner 2666 (P, US, W).

PARAGUAY: Sierra de Amambay, Hassler 10575 (MO, P, W), 10895 (W).

BOLIVIA: LA PAZ: San Bartolomé (near Calisaya), Krukoff 10108 (MO, U, US), 10108a (MO); Tuirí (near Mapiří), Krukoff 10892 (MO, U); Tumupasa, Cárdenas 1985 (K, NY).

*Aspidosperma macrocarpon* is a rather uniform population with glabrous, long-petioled leaves and appressed ferruginous-tomentellous inflorescences borne upon leafless twigs in the extreme northern and western portions of its range. In the central range and in the south, however, it becomes more variable, the leaves tending to be increasingly shorter-petioled and the inflorescences borne with the new foliage, both being more and more yellow-tomentose. Since these tendencies approach the characters of *A. verbascifolium*, which is indigenous to southern Brazil, I assume that the two species hybridize.

The most complete field notes on *A. macrocarpon*, unfortunately, are those by Ll. Williams accompanying the single, completely sterile specimen from Venezuela which is cited above: "N. v.: Platanote—Arbol de 20–22 m. de altura, lactífero;

copa angosta de pocas ramas erectas; el tronco es redondo, derecho, sin estribos, 25 cm. de diámetro, sin ramas por 9–10 m.; la corteza es áspera, gris claro y el liber rojo rosado exuda en abundancia un látex pegajoso; la madera es de color claro; las flores son terminales, de pétalos blancos; el fruto es dehiscente; en la margen entre la sabana y la selva de galería." In Bolivia, Cárdenas notes (sub 1985 in hb. N. Y.): "Big tree with very hard wood."

2. *ASPIDOSPERMA VERBASCIFOLIUM* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:46. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: *St. Hilaire* 825!).

*Macaglia verbascifolia* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Macaglia lanata* O. Ktze. loc. cit. 3<sup>2</sup>:197. 1898. (T.: *Kuntze s. n.!*).

*Aspidosperma lanatum* (O. Ktze.) Malme, in Arkiv. Bot. 21A, no. 6:20. 1927.

Apparently rather small trees, the branches disproportionally stout, with greatly condensed internodes and very thick periderm, yellow-tomentose to glabrate. Leaves broadly elliptic to elliptic-obovate, apex broadly obtuse to rounded, broadly decurrent to the petiole, about 10–30 cm. long and 7–16 cm. broad, firmly membranaceous, densely yellow-tomentose on both faces to glabrate or glabrous above; petioles about 1–2 cm. long. Inflorescences clustered subterminally at the uppermost nodes, corymbiform to subumbelliform, densely yellow-tomentose, 5–8 cm. long, the dichotomously branching secondary peduncles about equalling the primary, to more or less suppressed, the pedicels 3–5 mm. long. Calyx lobes ovate to ovate-lanceolate, acute, 3–4 mm. long, nearly equal, densely yellow-tomentose. Corolla white, densely yellow-tomentose without, the tube 6–7 mm. long, about 2.5 mm. in diameter at the insertion of the stamens, somewhat constricted at the base and at the orifice, slightly fissured behind the anthers, essentially glabrous within, the lobes oblong-elliptic, 9–10 mm. long. Stamens inserted about midway within the corolla tube, the anthers about 1.7 mm. long. Ovary ovoid, about 1.5 mm. long, glabrous or papillate; stigma subglobose. Follicles semicircular or broadly dolabriform, about 15 cm. long and 10 cm. broad, rather abruptly produced to a stipe about 6 cm. long, deep brown, irregularly striate and minutely velutinous-papillate; seeds circular, about 8 cm. in diameter.

South-central Brazil, in "cerrados"; flowering from August to October.

Vernacular names: *Panaceaia*; *Peroba do campo* (Oliveira); *Moela de emei* (A. Macedo); *Peroba amarga* (Duarte).

BRAZIL: GOIAZ: *St.-Hilaire* 825 (P); entre Diviza et Ponte Laurada, *Glaziou* 21741 (C, F, P). MATO GROSSO: *Kuntze s. n.* (W), *Smith s. n.* (R); Cuiabá, *Kuhlmann* 1227 (R). MINAS GERAIS: Uberava, *Regnell* 871 (F, US); Ituiutaba, *Macedo* 542 (MO); Patos de Minas, carmo do Paranaíba, *Oliveira* 1339 (MO); Serra de Catiara, *Duarte* 2938 (MO).

Very little is known about this species, which appears to hybridize with the preceding (*vide ante*). *Glaziou* (sub n. 21741 in Hb. Par.) describes the plant as "arbuste tortueux"; *Macedo* (sub n. 542 in Hb. Mo. Bot. Gard.) describes it merely as "tree".



## SERIES II. RAMIFLORA Woodson, n. ser.

Ser. *Macrobolbii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895, in part;  
 § *Macrantha* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947, in part.

Trees with milky latex, apparently evergreen, with rather thin, somewhat loose bark, rather inconspicuously lenticellate. Branches with naked, acuminate buds, the subtending internode definitely thicker than the terminal petiole, without definite seasonal articulations, but with internodes greatly shortened toward the tip of the branch, the two uppermost leaves appearing opposite as a rule. Leaves alternate, membranaceous, large, with widely arcuate secondary veins reticulating distally and with very apparent reticulate tertiary venation upon both surfaces. Inflorescence cauliflorous some distance from the tip of the branch, sessile, few-flowered, with persistent, evident bracts; corolla typically salverform, the lobes reflexed or horizontally spreading, the tube constricted at the orifice, relatively large and of thick texture, densely tomentellous without. Follicles rather large, broadly dolabriform, plano-convex, the placenta rotating about 270°, indefinitely papillate to essentially glabrous, very conspicuously lenticellate; seeds with a nearly circular, concentric wing.

*Species 3*

Figure 5.

3. *ASPIDOSPERMA RAMIFLORUM* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:55. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: Sellow 1651!).

*Geissospermum* ? *ramiflorum* Mart. ex Muell. Arg. loc. cit. 1860, *nom. nud.* in *synon.*; Miers, Apoc. So. Am. 85. 1878.

Trees 12–30 m. tall, with close, relatively thin bark. Leaves oblong to oblong-elliptic, acute at base and apex, about 9–20 cm. long and 4–8 cm. broad, membranaceous, glabrous; petioles 1–2 cm. long. Inflorescences sessile, few-flowered, cauliflorous on the younger branches several nodes below the tip. Calyx lobes ovate, acute, nearly equal, about 2 mm. long, densely ferruginous-tomentellous without. Corolla densely ferruginous-tomentellous without, the tube 7–10 mm. long, about 2 mm. in diameter at the insertion of the stamens, constricted at the thickened orifice and near the base, the lobes broadly oval to oblong-elliptic, obtuse to rounded, 6–12 mm. long. Stamens inserted about midway or slightly higher within the corolla tube, the anthers 1.0–1.5 mm. long. Ovary oblong-ovoid, about 1.5 mm. long, glabrous or somewhat ferruginous-pilose; stigma fusiform. Follicles obliquely oval, sessile or very shortly stipitate, 6–9 cm. long and 5–7 cm. broad, essentially glabrous, nearly covered with whitish lenticels; seeds broadly oval, about 6 cm. long and 4.5–5.0 cm. broad.

South-eastern Brazil and eastern Bolivia; dense forests; flowering from May until October.

Vernacular names: *Peroba amarella* (Brazil—Serviço Florestal do Brasil); *Tambú* (Brazil—Mexico).





Fig. 5. *Aspidosperma ramiflorum* Muell. Arg.: Flowering branch, dissected flower, fruit, and seed.

BRAZIL: Sellow 1651 (W); *Schubert s. n.* (F, GH, W). MINAS GERAIS: Fazenda de Aguada, Mexia 5054 (G, GH, K, MO, NY, S, U, US). RIO DE JANEIRO: Serra de Cinqué, Glaziov 9509 (C, P); S. Christorão, Morrada Telegrapho, Glaziov 6636 (C, F, P); Corcovado a Lagoa de Freitas, Glaziov 17132 (C, P); ad urbem in silvis montis Corcovado, Kublmann 16366 (U, US); Matta da Fabrica Carioca, Serviço Florestal 105 (MO).

BOLIVIA: LA PAZ: Guanai, Rusby 2649 (GH, NY, US); Huachi, White 1018 (NY).

White (sub no. 1018) describes the wood as hard and white; Mrs. Mexia (sub no. 5054) notes that the trunks are straight and slender, with hard wood, and producing good lumber. An attempt was made to distinguish the Brazilian population from the Bolivian upon morphological grounds, but without success.

## SERIES III. PYRICOLLA Woodson, n. ser.

Ser. *Macrolobii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895, in part; Ser. *Microlobii* K. Sch. loc. cit. 142. 1895, in part; § *Tetrasticha* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:363. 1947, in part; § *Glabriflora* M. Pichon, loc. cit. 1947, in part; § *Piliflora* M. Pichon, loc. cit. 364. 1947, in part; § *Macroloba* M. Pichon, loc. cit. 1947; § *Microloba* K. Sch. ex M. Pichon, loc. cit. 366. 1947.

Trees, occasionally shrubs, with milky latex, deciduous, with moderately thin rimose bark, conspicuously lenticellate. Branches with scaly buds, with definite seasonal articulations and with the leaves rather crowded toward the tips. Leaves alternate or irregularly approximate, membranaceous to subcoriaceous, moderately large to rather small, with widely arcuate secondary veins reticulating distally. Inflorescence terminal or subterminal, pedunculate, many- or few-flowered, without evident bracts; corolla typically salverform, relatively small, or if larger of delicately membranaceous texture. Follicles pyriform, unequally bi-convex, the placenta rotating about 180°, gradually narrowed to a conspicuous stipe, indefinitely papillate to essentially glabrous (densely yellow-tomentose in *A. tomentosum*), conspicuously lenticellate; seeds with a concentric, ovate wing acute at the base.

*Species 4-14*

Figure 6.

## KEY TO THE SPECIES

- a. Corolla lobes twice as long as the tube or somewhat longer.
  - b. Flowers relatively small, about 7 mm. long, glabrous; inflorescence many-flowered, dichotomous with the terminal flowers absent at least below..... 4. *A. MULTIFLORUM*
  - bb. Flowers relatively large, about 1.5 cm. long, glabrous or somewhat appressed-sericeous without; inflorescence few-flowered, regularly dichasial, the terminal flower always present; follicles nearly circular, conspicuously lenticellate, with or without an indistinct midrib..... 5. *A. PYRIFOLIUM*
- aa. Corolla lobes much shorter than the tube, or about as long.
  - b. Corolla lobes about as long as the tube.
    - c. Small-leaved shrub, glabrous throughout; flowers solitary in the upper leaf axils..... 6. *A. OLIGANTHUM*
    - cc. Large-leaved trees, the foliage and inflorescence densely yellow-tomentose; inflorescence many-flowered; follicles densely yellow-tomentose (leaves smaller and glabrate, follicles essentially glabrous in putative hybrids)..... 7. *A. TOMENTOSUM*
  - bb. Corolla lobes half as long as the tube or shorter.
    - c. Inflorescence many- or several-flowered.
      - d. Corolla lobes lanceolate, acuminate, about half as long as the tube; follicles usually about twice as long as broad, essentially glabrous, with a conspicuously elevated midrib on both faces, brown, conspicuously lenticellate..... 8. *A. SUBINCANUM*
      - dd. Corolla lobes ovate to reniform, obtuse to rounded, one-third to one-quarter as long as the tube.
        - e. Corolla lobes reniform, about one-quarter as long as the tube; inflorescence very densely red-tomentellous; follicles sub-elliptical, usually about three times as long as broad, with a conspicuously elevated midrib on both faces, prominently lenticellate, reddish-brown, finely red-tomentellous to glabrate.. 9. *A. PARVIFOLIUM*
        - ee. Corolla lobes ovate, about one-third as long as the tube.
          - f. Corolla tube relatively narrow, about one-fourth or less as wide as long; inflorescence white-, yellow-, or yellowish gray-pubescent.
          - g. Inflorescence somewhat shorter than the subtending petioles, white-sericeous; corolla 6.5-8.0 mm. long; follicles

nearly circular, grayish when dry, without a prominent midrib.

gg. Inflorescence somewhat longer than the subtending petioles; follicles subelliptic, less than about half as broad as long, brown when dry, midrib rather indefinite and

inequally manifest on either face.

h. Inflorescence rather loose, the axes yellow-pubescent to glabrate; corollas 6.5–7.0 mm. long; leaves oblanceolate to obovate, rounded to obtusish.

hh. Inflorescence quite dense, the axes densely yellowish gray-puberulent; corollas 5.0–5.5 mm. long; leaves elliptic, acute to acuminate.

ff. Corolla tube relatively broad, about half as broad as long; inflorescence yellow-pubescent; corolla about 4 mm. long; follicles subelliptic, about as long as broad, with a very prominently elevated midrib on both faces, yellowish or reddish-brown.

cc. Inflorescence of solitary flowers in the upper leaf axils; corolla

4.0–4.5 mm. long, the lobes about half as long as the tube.

4. *ASPIDOSPERMA MULTIFLORUM* A.DC. in DC. Prodr. 8:397. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:363. 1947. (T.: *Blanchet 28061*).

*Macaglia multiflora* (A.DC.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma Monteroi* Standl. ex Record & Hess, Timbers of the New World, 61. 1943; Record, in Trop. Woods 80:1. 1944, *nom. nud.*

Small to medium-sized trees with rather thin, reddish bark, glabrous throughout. Leaves elliptic, apex shortly and obtusely acuminate, base broadly obtuse to rounded, 5–11 cm. long, 3–6 cm. broad, membranaceous; petioles 1.5–2.5 cm. long. Inflorescences clustered subterminally at the uppermost nodes, 3–5 cm. long, the peduncles slender, 3–4 times dichotomous with the terminal flowers absent at the lower dichotomies, many-flowered. Calyx lobes ovate, acuminate, essentially equal, about 1.5 mm. long, scatteringly ciliolate. Corolla greenish white, glabrous without, the tube about 2 mm. long, about 0.7 mm. in diameter at the insertion of the stamens, somewhat constricted at the orifice and at the base, the lobes about 5 mm. long, narrowly oblong-elliptic. Stamens inserted at about midway within the corolla tube, the anthers 0.5–1.0 mm. long. Ovary ovoid, about 0.5 mm. long, glabrous, the stigma ovoid. Follicles compressed-pyriform, about 5 cm. long and 2.5 cm. broad, rather gradually narrowed to a stipe about 1 cm. long, with many conspicuous lenticels of varying size, with an indistinct midrib.

Eastern and southern Brazil; in savannas; flowering in October.

BRAZIL: BAIA: in certam fluvii S. Francisci, *Blanchet 2806* (C, F, P, W). MATO GROSSO: Salto Belo, Rio Sacre, *Baldwin 3115* (MO, US). PARA: Campina do Jupiry prope lacum Faro, *Ducke 21801* (MO, US).

The description of the fruit is drawn from *Ducke 21801*, which has been named *A. multiflorum* by my friend Dr. Markgraf. I am a bit doubtful of its real identity but do not know of a more sure disposition of it. I believe that *A. multiflorum* may hybridize with the *A. tomentosum* complex in Minas Gerais; this possibility will be discussed following the account of the latter species.

5. *ASPIDOSPERMA PYRIFOLIUM* Mart. Nov. Gen. & Sp. 1:60. 1824; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: *Martius s. n.*!).

*Aspidosperma refractum* Mart. loc. cit. 1824; M. Pichon, loc. cit. 1947. (T.: *Martius s. n.*!).

*Aspidosperma bicolor* Mart. loc. cit. 1824. (T.: *Martius s. n.*!).

*Aspidosperma populifolium* A.DC. in DC. Prodr. 8:397. 1844; M. Pichon, loc. cit. 1947. (T.: *Gardner 2664*!).

*Aspidosperma Martii* Manso, ex Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:48. 1860; M. Pichon, loc. cit. 1947. (T.: *Martius 485*!).

*Aspidosperma pyrifolium* Mart. *β. molle* Muell. Arg. loc. cit. 54. 1860. (T.: *Martius s.n.*!).

*Thyroma bicolor* (Mart.) Miers, Apoc. So. Am. 25. 1878.

*Macaglia pyrifolia* (Mart.) O. Ktze. Rev. Gen. 2:416. 1891.

*Macaglia refracta* (Mart.) O. Ktze. loc. cit. 1891.

*Macaglia bicolor* (Mart.) O. Ktze. loc. cit. 1891.

*Macaglia populifolia* (A.DC.) O. Ktze. loc. cit. 1891.

*Macaglia Martii* (Manso) O. Ktze. loc. cit. 1891.

*Aspidosperma guaranticum* Malme, in K. Sv. Vet. Akad. Handl. Bihang, 24, afd. 3, no. 10:7, pl. 1, fig. 1. 1899; M. Pichon, loc. cit. 1947. (T.: *Malme 1006*!).

Small to medium-sized trees 2–14 m. tall, usually with brittle, jointed, rimose branches, finely appressed-puberulent to glabrous when young. Leaves elliptic to ovate, frequently somewhat pandurate, apex acuminate to obtuse, base obtuse to rounded, 2–12 cm. long, 2–6 cm. broad, membranaceous, finely puberulent to glabrous; petioles 1–3 cm. long. Inflorescences borne with the young leaves, 2–5 cm. long, few- to several-flowered, regularly dichasial, the terminal flowers always present; pedicels 2–5 mm. long, minutely puberulent to glabrous. Calyx lobes ovate to ovate-lanceolate, acuminate, 2–3 mm. long, sparsely pilosulose. Corolla white, very fragrant, finely appressed-puberulent to essentially glabrous without, the tube 4–6 mm. long, about 1.5 mm. in diameter at the insertion of the stamens, the orifice constricted and thickened, the lobes lanceolate, narrowly acuminate, 1–2 cm. long. Stamens inserted in the upper third of the corolla tube, the anthers about 1 mm. long. Ovary ovoid, about 1 mm. long, glabrous; stigma subglobose, minutely pilosulose. Follicles nearly circular, shortly stipitate, the body 4–5 cm. long and 3–5 cm. broad, yellowish brown, conspicuously lenticellate, with or without an indistinct midrib, the stipe 0.5–1.0 cm. long; seeds broadly ovate, 5–6 cm. long and 3–4 cm. broad.

Widely distributed in eastern and southern Brazil and adjacent Paraguay; in dry scrub, thickets, and woodland (*caatinga* and *varzea*); flowering chiefly from September to January.

Vernacular names: *Pereiro* (Brazil—Luetzelburg); *Pereiro preto* (Brazil—Lisbôa); *Peroba paulista* (Brazil—Macedo); *Ivabay*, *Palo de rosa* (Paraguay—Malme).

BRAZIL: ALAGOAS: Paulo Afonso Falls, *Chase 7821* (F, GH, MO, US). BAÍA: Caiete et praedium Maracas, *Martius s. n.* (W); in silvis catingas, *Martius s. n.* (W); Geremoabo, *Schery 487* (MO); Caldeira, *Ule 7054* (K). CEARÁ: São Estevam, *Löfgren 770* (R); Sobral, *Dahlgren 928* (F, MO); Rio Pacoty at Fortaleza-Recife road, *Drouet 2719* (F, GH, MO), *2724* (F, GH, MO); locality lacking, *Allemão 967* (MO, P, R); *Gardner 1753* (GH, P, US, W). MATO GROSSO: Cujaba, *Martius 585* (W). MINAS GERAIS: Ituiutaba,

Macedo 2020 (MO), 2023 (MO). PARA: Viçosa, Lisboa 2435 (US). PARAHYBA: San Gonçalo, Luetzelburg 26800 (F, MO); Serra Borborema, Luetzelburg 12356 (F, US). PERNAMBUCO: locality lacking, Pickel 3497 (GH, F). PIAUHY: locality lacking, Gardner 2664 (P, US, W). RIO DE JANEIRO (?): locality lacking, Glaziov 11184 (C). PARAGUAY: Concepción, Hassler 7287 (MO, P, W), 7287a (MO); Colonia Risso pr. Rio Apa, Malme 1006 (R, S, US).

The type specimen of *Aspidosperma Martii* may represent a hybrid between *A. pyriforme* and *A. macrocarpon*. It consists of both fruits and flowers with foliage: the leaves and fruits can be referred to *A. pyriforme* without difficulty, but the flowers are rather densely tomentellous and the lobes are slightly shorter than the tube and are somewhat too broad for true *A. pyriforme*. In the original description Mueller suggested an affinity with *A. macrocarpon*.

Flowers and foliage of *A. pyriforme* appear to be somewhat more pubescent in its southern range than in the north, but I see no indications to suggest that this variation may be due to hybridization, although Sr. Macedo's specimens from Minas somewhat suggest *A. subincanum*, which occurs in the immediate vicinity.

6. *ASPIDOSPERMA oliganthum* Woodson, spec. nov.

Frutex parvus ut dicitur ramulis fragilibus geniculatis tenue rimosis glabris. Folia obovata apice rotundata basi cuneata ca. 1 cm. longa 5–8 mm. lata membranacea glabra opaca; petiolis ca. 2–3 mm. longis. Flores in axillis foliorum superiorum solitarii; pedicellis 2–5 mm. longis tenuissimis glabris. Calycis laciniae ovato-lanceolatae anguste acuminatae ca. 1.5 mm. longae glabrae. Corollae extus glabrae tubo ca. 2.5–3.0 mm. longo ca. 1 mm. diam. lobis anguste lanceolatis acuminatis 3.0–3.5 mm. longis. Stamina in tubo corollae medio inserta antheris ca. 0.5 mm. longis. Ovarii carpella depresso ovoidea truncata ca. 0.25 mm. alta glabra ovulis 2 (vel 4?); stigmatibus sessilibus fusiformibus ca. 0.3 mm. longis.

BRAZIL: BAIA: in der Catinga bei Tambury, October, 1906, Ule 7290 (K, TYPE).

A most peculiar reduced form recalling *A. reductum* of Paraguay, but apparently most closely related to *A. pyriforme*. Beside the tiny, solitary flowers and small foliage, the form of the ovary is remarkable.

7. *ASPIDOSPERMA TOMENTOSUM* Mart. Nov. Gen. & Sp. 1:58, t. 34. 1824; M.

Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: *Martius s. n.*!).

*Aspidosperma dasycarpon* A.DC. in DC. Prodr. 8:396. 1844; M. Pichon, loc. cit. 1947. (T.: *Claussen 346!*).

*Aspidosperma Gomezianum* A.DC. loc. cit. 397. 1844; M. Pichon, loc. cit. 1947. (T.: *Gardner 835!*).

*Aspidosperma velutinum* Fisch. ex Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:45. 1860, *nom nud.* in synonym.

*Aspidosperma tomentosum* Mart.  $\beta$ . *velutinum* Muell. Arg. loc. cit. 1860. (T.: *Riedel 628*).

*Aspidosperma tomentosum* Mart.  $\gamma$ . *angustifolium* Muell. Arg. loc. cit. 1860. (T.: *Riedel 671!*).

- Aspidosperma obscurum* Muell. Arg. loc. cit. 48. 1860; M. Pichon, loc. cit. 1947. (T.: Pohl 4314!).
- Aspidosperma camporum* Muell. Arg. loc. cit. 49. 1860; M. Pichon, loc. cit. 1947. (T.: Riedel 586).
- Aspidosperma Hilarianum* Muell. Arg. loc. cit. 50. 1860; M. Pichon, loc. cit. 1947. (T.: St.-Hilaire s. n.).
- Aspidosperma Warmingii* Muell. Arg. in Kjoeb. Vidensk. Meddel. 101. 1869; M. Pichon, loc. cit. 366. 1947. (T.: Warming s. n.).
- Aspidosperma pallidiflorum* Muell. Arg. loc. cit. 1869; M. Pichon, loc. cit. 364. 1947. (T.: Warming s. n.).
- Macaglia tomentosa* (Mart.) O. Ktze. Rev. Gen. 2:416. 1891.
- Macaglia dasycarpa* (A.DC.) O. Ktze. loc. cit. 1891.
- Macaglia Gomeziana* (A.DC.) O. Ktze. loc. cit. 1891.
- Macaglia obscura* (Muell. Arg.) O. Ktze. loc. cit. 1891.
- Macaglia camporum* (Muell. Arg.) O. Ktze. loc. cit. 1891.
- Macaglia Hilariana* (Muell. Arg.) O. Ktze. loc. cit. 1891.
- Aspidosperma Rojasii* Hassl. in Fedde, Repert. 12:257. 1913; M. Pichon, loc. cit. 363. 1947. (T.: Hassler [Rojas] 10629!).
- Aspidosperma Quirandy* Hassl. var. *angustifolium* Hassl. loc. cit. 260. 1913. (T.: Fiebrig 4292!).
- Aspidosperma Chodatii* Hassl. ex Mgf. in Notizbl. 8:427. 1923; M. Pichon, loc. cit. 366. 1947. (T.: Hassler [Rojas] 10647!).

Trees 4–25 m. tall, with disproportionally thick, heavily suberized branches with greatly condensed internodes (more slender and thinly rimose in putative hybrids). Leaves condensed at the tips of the flowering branches, sessile, oblanceolate to obovate, apex acute to rounded, base narrowly cuneate, 10–30 cm. long, 4–12 cm. broad, membranaceous, densely yellow-tomentose on both faces or glabrate above (smaller, petiolate, and wholly glabrous in putative hybrids). Inflorescences clustered subterminally in the axils of the upper leaves, 4–10 cm. long, densely yellow-tomentose, the flowers sessile or subsessile at the tips of the dichotomous peduncles. Calyx lobes narrowly ovate to lanceolate, acuminate to acute, 3–6 mm. long, densely yellow-tomentose. Corolla white to yellow, yellow-tomentellous without, the tube 3–5 mm. long, about 1 mm. in diameter at the insertion of the stamens, the lobes lanceolate, acuminate, 4–5 mm. long. Stamens inserted at about the upper third of the corolla tube, the anthers about 1 mm. long or somewhat less. Ovary ovoid, about 0.5 mm. long, glabrous; stigma fusiform, about 0.5 mm. long. Follicles broadly obovate, 5–6 cm. long and 3.0–3.5 cm. broad, shortly stipitate, densely yellow-tomentose, without a distinct midrib (glabrate and with or without a midrib in putative hybrids); seeds ovate, about 4 cm. long and 3 cm. broad.

Southern Brazil and adjacent Paraguay and Bolivia; in savannas and dry woodlands (*campos*, *cerrados*); flowering from July to November.

Vernacular names (Brazil): *Pereiro do campo* (Martius); *Paroba*, *Pequia* (Gardner); *Pão pereira do campo* (Warming); *Tambú* (Mexia); *Guatambú*, *Guatambú do cerrado* (Macedo); *Pequia de pedra* (Serviço Florestal).

BRAZIL: BAÍA: Caeté, Riedel 671 (W). MATO GROSSO: Fazenda das Moças, Campo Grande, Archer & Gebrt 135 (US); locality lacking, Kuntze s. n. (NY); Cuiabá, Kublmann 1230 (R). GOIAZ: Anapolis, Oliveira 1342 (MO); Alexandre, Glazion 21740 (P).



MINAS GERAIS: Ituiutaba, *Macedo* 520 (MO), 536 (MO), 711 (MO), 712 (MO), 737 (MO); Serra da Caraça, *Glaziou* 15211 (F, P); Serra do Lenheiro, prês S. João d'El Rei, *Glaziou* 17133 (C, P); Serra de Ouro Branco, *Glaziou* 12949 (C, P); Lagoa Santa, *Warming* s. n. (C, NY), *Engle* s. n. (C); Bello Horizonte, *Mello Barreto* 300 (F), 9222 (F, MO); Lagoa Santa, *Mello Barreto* 9213 (F, MO); Uberava, *Regnell* 871 bis (US); Fazenda do Diamante, base of Serra do Angico, *Mexia* 5669 (GH, MO, U, US); Patos de Minas, *Duarte* 3294 (MO). PARANÁ: Jaguariahyva, *Dusén* 13116 (F, GH, MO, US), 18022 (US); Itararé, *Dusén* 16514 (GH, MO), s. n. (GH, MO, NY, US); Patrimônio, *Dusén* 16780 (US); Cachoeirinha, *Whitford & Silveira* 126 (F, GH, US). RIO DE JANEIRO: Serra dos Orgãos, *Gardner* 835 (GH, NY, P, US); Ipanema, *Harsbberger* 842 (US); locality lacking, *Wilkes Exped.* s. n. (US). STA. CATHARINA: locality lacking, *Mueller* 170 (K). SÃO PAULO: Araraguara, *Löfgren* 936 (C). DATA LACKING: *Sello* 49 (U); *Reichardt* 13 (W), 32 (W); *Pohl* s. n. (W); *St.-Hilaire* s. n. (F, P, US); *Claussen* s. n. (G), 326 (P), 327 (F, P), 346 (G).

PARAGUAY: Sierra de Amambay, *Hassler [Rojas]* 10894 (MO, W), 10647 (MO, W), 10647a (MO, W), 10629 (MO, W), 10629a (MO, W), 10601 (MO, W); Concepción, *Hassler* 7199 (MO, W), 7199a (MO, W); Concepción, *Balsani* 1346 (K); zwischen Río Apa und Río Aquidabán, *Fiebrig* 4292 (GH).

BOLIVIA: LA PAZ: Sta. Ana, *d'Orbigny* 745 (P, W).

This is the most frequently collected as well as the most variable species of *Aspidosperma*. I strongly suspect the hybridization of it with three other species of the same area: *A. subincanum*, *A. australe*, and *A. parvifolium*. The four species are so distinctive in the characteristics of their stems, leaves, flowers, and fruits, as well as in their peculiar induments, that a tremendous range of recombination patterns is a table, and these are well represented in the specimens cited above. I have attempted to arrange the specimens into five groups as a very rough estimate of this putative hybridization. I hope that this problem will not escape the attention of some Brazilian botanist who is interested in natural hybridization.

GROUP I. ("Pure" *tomentosum*): Thick, heavily corky stems; large sessile leaves; long corolla lobes; inflorescence very condensed; follicles without a definite midrib—all densely yellow-tomentose.

GROUP II. (*Gomezianum*, etc.): More slender, thinly rimose stems; smaller, sessile or shortly petiolate, nearly or quite glabrous leaves; shorter corolla lobes; inflorescence much branched from near the base, finely puberulent; glabrous follicles without a definite midrib. (*tomentosum* × *australe*?).

GROUP III. (*Chodatii*): More slender, thinly rimose stems; large, long-petiolate leaves finely canescent or glabrate; long corolla lobes; inflorescence fairly long-pedunculate, finely puberulent to glabrate; follicles with a prominently elevated midrib. (*tomentosum* × *subincanum*?).

GROUP IV. (*camporum*, *Warmingii*, etc.): More slender, thinly rimose stems; small or medium-sized, shortly petiolate leaves; shorter corolla lobes; shortly pedunculate inflorescences—all very densely orange-tomentellous; follicles with a prominent midrib. (*tomentosum* × *parvifolium*?). It seems significant that this group is found in the southern coastal Brazilian states.

GROUP V. (backcrosses to *tomentosum*?): Much as in Group I, but stems somewhat more slender and with less corky bark.

The collections which my friend Sr. Macedo has sent me for study are helpful in this connection, since he has found trees of three of these groups, I, II, and V, within a single day's collecting, in the vicinity of Ituiutaba, Minas Gerais.

8. *ASPIDOSPERMA SUBINCANUM* Mart. ex A.DC. in DC. Prodr. 8:397. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Martius 262!*).

*Aspidosperma subincanum* Mart.  $\beta$ . *tomentosum* Muell. Arg. in Mart. Fl. Bras. 6:50. 1860. (T.: *Claussen s. n.!*).

*Macaglia subincana* (Mart.) O. Ktze. Rev. Gen. 2:416. 1891.

Tree as much as 25 m. tall, with moderately stout, knotty, thinly rimose branches. Leaves broadly elliptic, abruptly acuminate, broadly decurrent to the petiole, 9–18 cm. long, 4–11 cm. broad, thinly membranaceous, finely and densely cinereous-puberulent to glabrous beneath, glabrous above. Inflorescences in the uppermost leaf axils, 3–8 cm. long, many-flowered, conspicuously pedunculate, densely cinereous-puberulent; pedicels 1–3 mm. long. Calyx lobes ovate-lanceolate, acuminate, about 2 mm. long, densely cinereous-pilosulose. Corolla yellow, finely pilosulose without, the tube about 4 mm. long and 1 mm. in diameter at the insertion of the stamens, constricted at the orifice and above the base, the lobes elliptic-lanceolate, obtusely acuminate, 2.0–2.5 mm. long. Stamens inserted in the upper third of the corolla tube, the anthers about 1 mm. long. Ovary ovoid, about 1 mm. long, minutely puberulent; stigma fusiform, about 0.5 mm. long. Follicles obovate, shortly stipitate, 3–4 cm. long and 2–3 cm. broad, with a prominent midrib, conspicuously lenticellate, essentially glabrous; seeds ovate, about 3.5 cm. long and 2.5 cm. broad.

Southern Brazil; forests and woodlands (*capoes*, *capeiras*, *cerradas*); flowering from September until November.

Vernacular names: *Pão pereira do mato* (Warming); *Guatambú* (Macedo); *Carrasco* (Krukoff).

BRAZIL: GOIAZ: near Coco, upper Rio Tocantins, *Krukoff 2067* (K, NY, U, US); Goiaz, *Burcbell 6591* (K), *7305* (K). MINAS GERAIS: Ituiutaba, *Macedo 2021* (MO), *2025* (MO); Uberava, *Regnell 868* (C, F, R, US); Lagoa Santa, *Warming s. n.* (C, NY); Bello Horizonte, *Magalhães 652* (MO); locality lacking, *Claussen s. n.* (G), *328* (C, F, GH, NY, P, US); *St.-Hilaire s. n.* (P); Sebastianopolis, *Pohl 2185* (W). MATO GROSSO: Cuyabá, *Martius 262* (MO, P, W), *Malme 1640* (R). SÃO PAULO: Araraguara, *Löfgren 972* (C).

The possibility of hybridization of this species with *A. tomentosa* has been discussed under the latter; the unusually large leaves and longer pedunculate inflorescences of a specimen of *A. pyrifolium* collected at Ituiutaba by Sr. Macedo suggest possible hybridization with that species as well.

9. *ASPIDOSPERMA PARVIFOLIUM* A.DC. in DC. Prodr. 8:398. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Guillemin 604!*).

*Thyroma parvifolia* (A.DC.) Miers, Apoc. So. Am. 25. 1878.

*Aspidosperma ingratum* K. Sch. in Engl. Bot. Jahrb. 30, Beibl. 67:30. 1901; M. Pichon, loc. cit. 1947. (T.: *Glaziov 17697!*).

Small or medium-sized trees, the branches somewhat stout, densely reddish-tomentellous when young, becoming glabrate. Leaves obovate-elliptic, acute to rounded, 4–10 cm. long and 1–4 cm. broad, firmly membranaceous, densely reddish-tomentellous to glabrate or glabrous beneath, glabrous above; petioles 1–2 cm. long. Inflorescences subterminal at the upper nodes, densely reddish-tomentellous, 2–4 cm. long, loosely or densely flowered; pedicels 1–2 mm. long. Calyx lobes ovate, acute to obtusish, 1.5–2.0 mm. long, densely reddish-tomentellous. Corolla greenish, densely reddish-tomentellous without, the tube 4–5 mm. long, 1.0–1.5 mm. in diameter at the insertion of the stamens, the lobes ovate-reniform, 1.0–1.5 mm. long. Stamens inserted at the upper third within the corolla tube, the anthers about 1 mm. long. Ovary ovoid, about 1 mm. long, densely and minutely reddish-puberulent, the stigma ovoid, about 0.5 mm. long. Follicles sub-elliptical, about 5–6 cm. long and 2.5–4.0 cm. broad, gradually narrowed to a stipe 1.5–2.0 cm. long, reddish brown, with a prominently elevated midrib; seeds oval, about 5 cm. long and 3 cm. broad.

Eastern Brazil; in woodlands; flowering from January to July.

Vernacular names: *Piquia* (Guillemin); *Tambú café* (Mello Barreto).

BRAZIL: BAÍA: Machado Portello, *Rose & Russell 1994I* (NY, US). MINAS GERAIS: Fazenda da Cachoeira, Tombos, *Mello Barreto 1393* (F), *Oliveira 325* (MO). RIO DE JANEIRO: Sumaré, *Kublmann 4373* (U, US); Alto Macahe, *Glaziou 12075* (C, P), *17131* (P), *17697* (P), *18366* (C, P). SÃO PAULO: Ubatuba, *Guillemin 604* (G); locality lacking, *Riedel s. n.* (G, GH, U, W), *Pohl s. n.* (W).

Like the other species of the series PYRICOLLA, *A. parvifolium* appears to hybridize with others growing within pollinating distance. I interpret in this way the somewhat variable color and abundance of the characteristic indument as well as variability in leaf size and shape. The tendencies of this variation rather suggest *A. pyricollum* as a hybridizing agent.

10. *ASPIDOSPERMA AUSTRALE* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:58. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Sellow s. n.*!).

*Aspidosperma argenteum* Muell. Arg. in Kjoeb. Vidensk. Meddel. 104. 1869; M. Pichon, loc. cit. 363. 1947. (T.: *Warming s. n.*!).

*Macaglia australis* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma Quirandy* Hassl. in Fedde, Repert. 12:259. 1913; M. Pichon, loc. cit. 366. 1947. (T.: *Hassler 2329!*!).

*Aspidosperma Quirandy* Hassl. var. *campestre* Hassl. loc. cit. 1913. (T.: *Hassler 7199!*!).

*Aspidosperma Quirandy* Hassl. var. *silvaticum* Hassl. loc. cit. 1913. (T.: *Hassler 10601!*!).

*Aspidosperma australe* Muell. Arg. var. *estrellense* Hassl. loc. cit. 263. 1913. (T.: *Hassler 10651!*!).

*Aspidosperma australe* Muell. Arg. var. *erythroxylum* Hassl. Addenda Pl. Hassl. 12. 1917, nom. nud.

*Aspidosperma australe* Muell. Arg. var. *longepetiolatum* Hassl. loc. cit. 1913, nom. nud.

*Aspidosperma occidentale* Malme, Arkiv Bot. 21A<sup>6</sup>:10. 1927; M. Pichon, loc. cit. 366. 1947, non Mgf. (T.: *Malme 2732!*!).

*Aspidosperma missionum* Speg. in: Physis 3:336. 1917. (T.: *Spegazzini 12685*—photo US!).

Trees 3–20 m. tall, the trunk with suberized bark, the branches rather slender and thinly rimose. Leaves ovate- to narrowly oblong-elliptic, apex obtuse to

acuminate, base obtusely cuneate to rounded, 5–12 cm. long, 1.5–5.0 cm. broad, firmly membranaceous, glabrous or inconspicuously pilosulose beneath when young; petioles 1.5–5.0 cm. long. Inflorescence densely clustered subterminally at the upper nodes, divaricately branched from near the base, 2–4 cm. long, densely appressed-puberulent; pedicels 2–3 mm. long. Calyx lobes ovate, acute, 1.5–2.0 mm. long, appressed-puberulent. Corolla greenish or yellowish, very densely white-sericeous without, the tube 5–6 mm. long, about 1.5 mm. in diameter at the insertion of the stamens, the lobes ovate, 1.5–2.0 mm. long. Stamens inserted at the upper third within the corolla tube, the anthers about 1 mm. long or somewhat less. Ovary broadly ovoid, about 1 mm. long, densely sericeous, the stigma oblongoid, about 1 mm. long. Follicles nearly circular, 3–4 cm. long and 2.5–3.0 cm. broad, without a midrib or indefinitely striate, essentially glabrous, usually grayish, the stipe 0.5–1.5 cm. long; seeds ovate, about 3.5 cm. long and 2.5 cm. broad.

Southern Brazil and adjacent Paraguay, Argentina, and Bolivia; in light woods; flowering in September and October.

Vernacular names: *Tambú verde* (Brazil—Magalhães); *Tambú canudo* (Brazil—Magalhães, Oliveira).

BRAZIL: MATO GROSSO: Corumbao, *Malme* 2732 (S). MINAS GERAIS: Belo Horizonte, *Magalhães* 378 (MO), 689 (MO); Oliveira, *Magalhães* 4447 (MO); Sta. Luzia, *Magalhães* 4446 (MO); Betim, *Magalhães* 612 (MO); Araxa, *Oliveira* 1345 (MO); Arcos, *Oliveira* 252 (MO); Lagôa Santa, *Warming* s. n. (C), *Engel* 1056 (C). RIO GRANDE DO SUL: São Leopoldo, *Leite* 2327 (GH); São Leopoldo, *Dutra* 772 (R). SÃO PAULO: locality lacking, *Mosen* 2532 (C, P, R). DATA LACKING: "Brasília meridionalis", *Sellow* s. n. (W).

PARAGUAY: Villa Rica, *Jørgensen* 3690 (C, F, GH, MO, US); Gran Chaco, *Hassler* 2329 (K, MO, W); Estrella, *Hassler* [Rojas] 10651 (MO, W); Sierra de Amambay, *Hassler* [Rojas] 10755 (K, W).

BOLIVIA: COCHABAMBA: between Vila-Vila and Misque, *Cárdenas* 2146 (MO, US). STA. CRUZ: Cercado, *Steinbach* 6394 (K); locality lacking, *Herzog* 1682 (G).

ARGENTINA: MISIONES: "in Hort. Agron. La Plata (ex Misiones), ejemplares típicos cultivados por el Dr. Spegazzini", *Hauman* 3535 (MO).

The Hauman sheet was received without a name, and may represent *A. missionum* Speg., since it corresponds well with the photograph of the type specimen.

*Aspidosperma australe* is a very well-marked species, but appears to hybridize with both *A. tomentosum* and *A. pyricollum*.

11. *ASPIDOSPERMA PYRICOLLUM* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:58. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Weddell* 445!).

*Aspidosperma Riedelii* Muell. Arg. loc. cit. 56. 1860; M. Pichon, loc. cit. 1947. (T.: *Riedel* 2771!).

*Aspidosperma Sellowii* Muell. Arg. loc. cit. 1860; M. Pichon, loc. cit. 1947. (T.: *Sellow* s. n.!).

*Aspidosperma olivaceum* Muell. Arg. loc. cit. 57. 1860; M. Pichon, loc. cit. 1947. (T.: *Sellow* s. n.!).

*Aspidosperma olivaceum* Muell. Arg.  $\beta$ . *obtusifolium* Muell. Arg. loc. cit. 58. 1860. (T.: *Sellow* s. n.!).

*Aspidosperma pyricollum* Muell. Arg.  $\gamma$ . *obovatum* Muell. Arg. loc. cit. 1860. (T.: *Sellow* s. n.!).

*Thyroma Riedelii* (Muell. Arg.) Miers, Apoc. So. Am. 26. 1878.

- Thyroma Sellowii* (Muell. Arg.) Miers, loc. cit. 24. 1878.  
*Macaglia olivacea* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.  
*Macaglia pyricolla* (Muell. Arg.) O. Ktze. loc. cit. 1891.  
*Aspidosperma Riedelii* Muell. Arg. var. *genuinum* Hassl. in Fedde, Repert. 12:262. 1913.  
*Aspidosperma Riedelii* Muell. Arg. var. *genuinum* Hassl. forma *microphyllum* Hassl. loc. cit. 1913. (T.: Balansa 1344).  
*Aspidosperma Sellowii* Muell. Arg. var. *genuinum* Hassl. loc. cit. 263. 1913.  
*Aspidosperma Sellowii* Muell. Arg. var. *collinum* Hassl. loc. cit. 1913. (T.: Hassler 4044).  
*Aspidosperma bello-horizontinum* A. Silv. in Arch. Mus. Nac. Rio Jan. 23:159, pl. 1. 1921; M. Pichon, loc. cit. 1947. (T.: Silveira 570).  
*Aspidosperma longipetiolatum* Kuhlmann in Anais Prim. Reun. Sul-Am. Bot. 3:86, t. 15. 1940. (T.: Kublmann 29793).

Trees 3–10 m. tall, the branches relatively slender, thinly rimose. Leaves oblanceolate to broadly oval-obovate, acute to rounded at the tip, base acutely cuneate, rarely broadly obtuse, 3–10 cm. long, 1–6 cm. broad, firmly membranaceous, glabrous; petioles 1–2 cm. long. Inflorescence subterminal at one or more of the upper nodes, 2–5 cm. long, distinctly pedunculate, very inconspicuously yellow-puberulent to essentially glabrous; pedicels 1–2 mm. long. Calyx lobes ovate to ovate-lanceolate, acute to obtuse, 1–2 mm. long, inconspicuously pilosulose to essentially glabrous. Corolla greenish or yellowish, finely pilosulose or papillate without, the tube 5.0–5.5 mm. long and about 1.5 mm. in diameter at the insertion of the stamens, the lobes ovate, acute to obtuse, 1.5–2.0 mm. long. Stamens inserted at about the upper third within the corolla tube, the anthers 1–2 mm. long. Ovary ovoid, about 1 mm. long, sparsely pilosulose, the stigma fusiform, about 1 mm. long. Follicles elliptic-pyriform, the body 4–6 cm. long and 2.5–3.0 cm. broad, with a more or less definite midrib, brown, gradually narrowed to a stipe 1.0–1.5 cm. long; seeds oval, 3–4 cm. long and about 2.5 cm. broad.

Southern Brazil; in woodlands (*restingas*); flowering from October to December.

Vernacular names (Brazil): *Guatambú* (Serviço Florestal, Magalhães, Malme); *Pequiá da restinga* (Serviço Florestal); *Amarellão* (Ducke); *Pequiá* (Glaziov).

BRAZIL: ACRE: Rio Acre, Ducke 207 (US). MINAS GERAIS: Caldas, Nova Ponte, Magalhães 203 (MO); Limo Duarte, Magalhães 480 (MO); Regnell 869 (C, F, GH, P, R, U, US); Serra do Cipó, Duarte 2257 (MO). PARAÍBA: Areia, Vasconcellos 243 (MO). RIO DE JANEIRO: Tejuco, Pohl 4315 (W); Corcovado, Gardner 5542 (K), Ducke & Kublmann 15387 (MO); Serra dos órgãos, Barbosa s. n. (MO); Praia do Pinto, Constantino 2170 (U); horto botânico cultum, Constantino 7825 (U, US); Recreio dos Bandeirantes, Lutz 547 (F, R, US); Mundo Novo, Kublmann 15346 (U, US); restinga da Copacabana, Glaziov 5000 (C), Raben s. n. (C); montem Dois Crimãos, Warming s. n. (C); Ipanema, Riedel 2771 (W), Serviço Florestal 109 (MO); environs de Rio-Janeiro, Weddel 445 (P, W); Horto Florestal 108 (MO); St. Louis, Glaziov 4079 (C, F, P); Alto Macahé de N. Friburgo, Glaziov 18364 (C, P), 19630 (C, P); Carahy, Engle s. n. (C); Corcovado, Ducke & Kublmann 15387 (MO). STA. CATARINA: Itajai, Muller 121 (R). SÃO PAULO: Jardim Botânico, Hoebne 28544 (F, GH, MO); locality lacking, Lund s. n. (C). DATA LACKING: Glaziov 636 (C), 637 (C), 1586 (C), 2923 (C), 5933 (C), 18365 (C); Sellow s. n. (U, W); Riedel s. n. (GH, U, W).

This species is a bit difficult to distinguish from *A. australe* at times, but usually may be told by the nearly glabrous inflorescence which appears to be rather flat-topped, while it seems to be almost spherical in *A. australe*. The fruits, of



course, are quite different. I think it possible that *A. pyricollum* may hybridize with *A. australe* to the south and with *A. Ulei* to the north, while the plants usually referred to *A. Sellowii* show some indications of *A. parvifolium*.

12. *ASPIDOSPERMA VARGASII* A.DC. in DC. Prodr. 8:399. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Vargas s. n.*!).

*Macaglia Vargasii* (A.DC.) O. Ktze. Rev. Gen. 2:416. 1891.

Trees 3–20 m. tall, the branches relatively slender, with close thin bark. Leaves elliptic to obovate, shortly acuminate, obtusely to acutely cuneate, 5–12 cm. long, 3–6 cm. broad, firmly membranaceous, glabrous; petioles 1.0–1.5 cm. long. Inflorescences clustered subterminally at the uppermost nodes, densely flowered, densely puberulent, 2–5 cm. long; pedicels about 1 mm. long. Calyx lobes ovate, acute, about 2 mm. long, minutely pilosulose. Corolla white, densely pilosulose without, the tube 3.5–4.0 mm. long, about 1 mm. in diameter at the insertion of the stamens, the lobes ovate, about 1.5 mm. long. Stamens inserted in the upper third of the corolla tube, the anthers about 1 mm. long. Ovary ovoid, about 1 mm. long, densely puberulent; stigma ovoid, about 0.5 mm. long. Follicles pyriform, about 4–5 cm. long and 2.5–3.0 cm. broad, gradually narrowed to a stipe 0.5–1.0 cm. long, with a definite midrib; seeds ovate, about 4 cm. long and 2.5 cm. broad.

Venezuela and adjacent Colombia and Guiana; rocky arid slopes and transition forest; flowering from June to September.

Vernacular names: *Amarillo* (Venezuela—Curran & Haman); *Yema de buevo* (Venezuela—Steyermark, Ll. Williams); *Walababadan* (Surinam—Boschwezen); *Quillo bordón* (Peru—Woytkowski).

COLOMBIA: data lacking, *Mutis* 5216 (US).

VENEZUELA: ARAGUA: Parque Nacional, *Ll. Williams* 10125 (F). BOLIVAR: La Prision, Medio Caura, *Ll. Williams* 11712 (F, K, MO, US); Guayapo, Bajo Caura, *Ll. Williams* 11829 (F, MO, US). DISTRITO FEDERAL: Antimano, *Pittier* 13381 (F, MO, NY, US); between La Guaira and Rio Grande, *Curran & Haman* 973 (GH, US); Curucutí, *Pittier* 7773 (GH, US), 9851 (GH, US); between Caracas and La Guaira, *Pittier* 51 (GH, US), 8695 (GH, US), 10380 (GH, NY, US), 11888 (F, G, MO, NY, US), *Delgado* 194 (F), *Rose* 21912 (GH, US), *Fendler* 1299 (GH—in part, K); Caracas, *Vargas s. n.* (G). SUCRE: Cerro Imposible, *Steyermark* 62923 (MO, US); Rio Guagua, *Steyermark* 62786 (MO). TACHIRA: San Cristóbal, *Archer* 3201 (US).

SURINAM: Sectie O, Wood Herbarium, *Surinam* 323 (K, U).

PERU: HUANUCO: Shapajilla, *Woytkowski* 26 (F, MO). SAN MARTIN: Tarapoto, *Ll. Williams* 6231 (F, MO, US).

The timber is said to be rather hard, yellow, and with a bitter taste. Possible hybridization of *A. Vargasii* and *A. Ulei* is discussed briefly under the latter species.

13. *ASPIDOSPERMA ULEI* Mgf. in Notizblatt 9:78. 1924. (T.: *Ule* 8453, photo. MO!).

*Aspidosperma occidentale* Mgf. loc. cit. 15:133. 1940, non Malme. (T.: *Ule* 9700!).

Trees 3–40 m. tall, with relatively slender, thinly rimose branches. Leaves obovate to obovate-elliptic, obtuse or rounded to acute, base narrowly or broadly





Fig. 6. *Aspidosperma Ulei* Mgf.: Flowering branch, entire and dissected flowers, entire and split fruit showing seed.

cuneate, 4–10 cm. long, 2–5 cm. broad, membranaceous, glabrous above, densely yellow-puberulent to glabrate beneath; petioles 1–2 cm. long. Inflorescences one to several at the upper nodes, densely yellow-puberulent, 3–5 cm. long, relatively lax and long-pedunculate; pedicels about 1 mm. long. Calyx lobes ovate, acute, 1–2 mm. long, minutely yellow-puberulent. Corolla greenish white to yellow, densely yellow-puberulent without, the tube about 3 mm. long and 1.5 mm. in diameter, the lobes ovate, about 1 mm. long. Stamens inserted at the upper third within the corolla tube, the anthers somewhat less than 1 mm. long. Ovary ovoid, about 1 mm. long, densely and minutely puberulent, the stigma ovoid, less than 0.5 mm. long. Follicles pyriform, about 4 cm. long and 3–4 cm. broad, rather abruptly narrowed to a stipe about 1 cm. long, with a prominently elevated midrib; seeds ovate, about 4 cm. long and 3 cm. broad.

Northern Brazil and adjacent Venezuela; in mixed low bush and transitional forest; flowering from October to June.

VENEZUELA: GUARICO: between Ortiz and Guarico Bridge, *Pittier 12225* (NY, US); near Para Para, *Archer 3022* (US).

BRITISH GUIANA: Kumuparu, Demerara River, *Forest Dept. 2536* (K); Kanuku Mountains, Takutu River, *A. C. Smith 3151* (MO, U, US), *3389* (MO, U, US).

BRAZIL: ACRE: Rio Acre, *Ule 9700* (K). AMAZONAS: Surumu, Rio Branco, *Ule 8451* (G, U); Serra Grande, Rio Branco, *Ducke 34947* (U, US). BAÍA: Bonfim, *Curran 148* (GH, MO, US). PERNAMBUCO: Tapera, *Pickel 2994* (F, GH).

Markgraf cited both *Ule 8452* and *8453*; the latter was photographed by Macbride and prints are distributed in many herbaria. As far as I can learn, both sheets were lost in the destruction of the herbarium at Berlin-Dahlem, and I have been unable to find duplicates. However, *Ule 8451* was collected at the same locality and on the same date as the type specimens and corresponds very closely with the photograph of *Ule 8453*.

*Aspidosperma Ulei* appears to hybridize with both *A. Vargasii* and *A. pyricollum*, to judge from our meagre herbarium representation: the specimens from British Guiana tend to glabrate foliage, and the fruits from Venezuela have indefinite midribs; the small, obovate-oblong leaves of the specimen from Pernambuco are very suggestive of those of *pyricollum*, although the fragments of inflorescence show the characteristically dense, yellow pubescence of *A. Ulei*.

I feel myself fortunate in having discovered the isotype of *A. occidentale* Mgf. non Malme (*Ule 9700*) amongst the undetermined specimens from Kew. It is flowering, and almost unquestionably referable to *A. Ule* Mgf. Before finding this specimen, the only one which I had to represent *A. occidentale* was *Krukoff 5470*, cited by Markgraf as a paratype and seen by me amongst the specimens at Geneva, Stockholm, and Washington.

The difficulty lay in the fact that the specimen was in fruit, and that Markgraf did not describe fruit for *A. occidentale*. Furthermore, the fruits are of a type which is unfamiliar to me otherwise: it is strongly unequal-biconvex, about 5 cm. long and 4 cm. broad, apparently sessile, quite woody, dark brown with prominent lenticels. The whole suggests the fruits of *A. ramiflorum* to me, although it is not that species. It most definitely is not the fruit of *A. Ulei*, and may represent a new species, perhaps a second for the RAMIFLORA. However, this study has impressed upon me the dangers of describing new species of *Aspidosperma* from fruit alone, and I shall forbear in this case.

#### 14. *ASPIDOSPERMA reductum* (Hassl.) Woods., stat. nov.

*Aspidosperma Riedelii* Muell. Arg. ssp. *reductum* Hassl. in Fedde, Repert. 12:262. 1913. (T.: Fiebrig 337!).

Small tree with relatively slender, gnarled, loosely rimose branches. Leaves obovate-spatulate, apex broadly rounded, narrowly cuneate to a subpetiolar base, 1.5–2.5 cm. long, 4–9 mm. broad, wholly glabrous. Flowers borne singly in the axils of the uppermost leaves; pedicels 2–3 mm. long, glabrous. Calyx lobes oblong-spatulate, obtuse or rounded, 2.5–3.0 mm. long, glabrous. Corolla appar-

ently greenish-white, glabrous or indefinitely papillate without, the tube about 3 mm. long, about 1 mm. in diameter at the insertion of the stamens, the lobes obovate-oblong, about 1.5 mm. long. Stamens inserted at about the upper third within the corolla tube, the anthers somewhat less than 1 mm. long. Ovary ovoid, about 0.5 mm. long, minutely sericeous, the stigma about 0.25 mm. long.

PARAGUAY: Cordillera de Altos, Fiebrig 337 (F, G).

Like many other small-leaved specimens of the series PYRICOLLA, particularly if sterile, this plant was associated with *A. Riedelii* by Dr. Hassler. The peculiar calyx lobes of this plant, however, are quite unlike those of any other of the genus which I have examined. A close parallel is found in the uniflorous *A. oliganthum* of northern Brazil, but the flowers of the two species are quite different.

#### SERIES IV. POLYNEURA Woodson, n. ser.

Ser. *Macrolobii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895, in part; Ser. *Microlobii* K. Sch. loc. cit. 142. 1895, in part; § *Tetrasticha* M. Pichon, in Bull. Mus. Nat. Hist. ser. 2, 19:363. 1947, in part; § *Reticulata* M. Pichon, loc. cit. 366. 1947.

Trees or shrubs with rather scanty colorless or milky latex, apparently evergreen, with rather close, thin, conspicuously lenticellate bark. Branches with naked or scaly (*A. polyneuron*), acuminate buds, the subtending internode definitely thicker (or scarcely thicker in *A. cuspa*) than the terminal petiole, with (*A. polyneuron*) or without definite seasonal articulations. Leaves alternate, firmly membranaceous, rather small to moderately large, with prominent reticulate venation upon both surfaces, the secondary veins widely arcuate. Inflorescence terminal or subterminal, thyriform to cymiform, with persistent but irregularly disposed and frequently obscure bracts; corolla tubular or tubular-salverform, rather coriaceous, glabrous without (but more or less puberulent-papillate toward the upper tube and lobes in *A. polyneuron* and *A. dispermum*); ovary essentially terete. Follicles falciform to subcylindric, somewhat concave- to somewhat bi-convex, the placenta rotating about 45°–135°, sessile, essentially glabrous, conspicuously lenticellate; seeds with a narrow, strongly excentric basal wing (concentric in *A. dispermum*).

Species 15–18

Figure 7.

#### KEY TO THE SPECIES

- a. Inflorescences clustered subterminally in the uppermost leaf axils, dichasial, the bracts inconspicuous or caducous, the flowers definitely pedicellate; seeds with an excentric or concentric wing, the embryo bilaterally symmetric.
  - b. Corolla more or less puberulent without, the lobes about half as long as the tube; inflorescence more or less densely puberulent.
    - c. Inflorescence relatively lax, white-puberulent; leaves broadly elliptic to ovate-elliptic, the reticulate tertiary venation emersed; follicles broadly elliptic, not obviously lenticellate, the seeds with a narrow, concentric wing..... 15. *A. DISPERMUM*
    - cc. Inflorescence relatively dense, gray-puberulent; leaves obovate- to oblong-elliptic, the reticulate tertiary venation very prominent on both surfaces; follicles clavate-oblong, very conspicuously lenticellate, the seeds with an elongate, obtuse, basal wing..... 16. *A. POLYNEURON*

- bb. Corolla glabrous without, the lobes about twice as long as the tube; inflorescence very lax, glabrous or rarely somewhat puberulent; leaves ovate-elliptic, the reticulate tertiary venation emersed; foli-  
 cles stoutly clavate-oblong, very conspicuously lenticellate, the seeds with a short, acute, basal wing..... 17. *A. CYLINDROCARPON*
- aa. Inflorescence solitary, usually terminal, monochasial, the bracts persistent, relatively conspicuous, the flowers sessile; foli-  
 cles subreniform, obviously lenticellate, the seeds with an excentric, elongate, obtuse, basal wing, the embryo bilaterally asymmetric..... 18. *A. CUSPA*

15. *ASPIDOSPERMA DISPERMUM* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:60. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Riedel 1091!*).

*Macaglia disperma* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

Trees about 6 m. tall, the branches relatively slender, minutely puberulent when young, glabrate and thinly rimose at maturity. Leaves broadly elliptic to ovate-elliptic, the apex abruptly and shortly acuminate to obtuse, the base broadly obtuse, 5–12 cm. long, 2–7 cm. broad, firmly membranaceous, the reticulate tertiary venation emersed, glabrous; petioles 2–3 cm. long. Inflorescences clustered subterminally in the uppermost leaf axils, dichotomously dichasial, 2–5 cm. long, the peduncles and pedicels densely white-puberulent, the bracts very minute; pedicels about 1 mm. long. Calyx lobes broadly ovate-trigonal, acute to obtuse, about 0.5 mm. long, densely white-puberulent. Corolla greenish, the tube about 2.5 mm. long and 1 mm. in diameter, glabrous without, the lobes oblong, rounded, about 1.5 mm. long, sparsely appressed-pilosulose without. Stamens inserted somewhat above midway within the corolla tube, the anthers about 0.7 mm. long. Ovary ovoid, glabrous, about 0.5 mm. long, the stigma subcapitate. Follicles broadly elliptic, acuminate, 2–3 cm. long, 1–2 cm. broad, sessile, with a prominent midrib, not obviously lenticellate; seeds 2, oval, about 2 cm. long and 1.0–1.5 cm. broad, with a narrow concentric wing and a bilaterally symmetric embryo.

Southeastern Brazil on rocky hillsides and *carrascos*.

Vernacular name: *Pereiro da serra* (Mello Barreto).

BRAZIL: MINAS GERAIS: Serra da Lappa, *Riedel 1091* (G, NY, U, W); Diamantina, *Mello Barreto 9861* (F).

Although transitional to the species of series *PYRICOLLA* in the concentrically winged seeds, the reduction of the seed number to two is the most advanced of that tendency in the series *POLYNEURA*. It is odd that this species has not been collected more frequently, since Mello Barreto reports that it is very abundant in the municipality of Diamantina. Nevertheless, *A. dispermum* must be of relatively limited distribution; specimens from eastern Peru which have been referred to it clearly represent *A. polyneuron*.

16. *ASPIDOSPERMA POLYNEURON* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:57. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: *Riedel 2332!*).

*Aspidosperma Peroba* All. ex Sald. Config. & Descr. Madeiras Rio Jan. 9, 104. 1865. (T.: *Beaurepaire s. n.!*)

*Aspidosperma venosum* Muell. Arg. in Kjoeb. Vidensk. Meddel. 103. 1869. (T.: *Warming s. n.!*).

*Thyroma polyneura* (Muell. Arg.) Miers, Apoc. So. Am. 24. 1878.

*Aspidosperma polyneuron* Muell. Arg. var. *genuinum* Hassl. in Fedde, Repert. 12:260. 1913.

*Aspidosperma polyneuron* Muell. Arg. var. *longifolium* Hassl. loc. cit. 1913. (T.: Hassler 10408a!).

*Aspidosperma Dugandii* Standl. in Trop. Woods 36:15. 1933. (T.: Dugand 355!).

Trees 8–20 m. tall, the trunk as much as 80 cm. thick, the branches relatively slender, glabrous, thinly rimose. Leaves oblong- to obovate-elliptic, shortly and abruptly acuminate to obtuse or rounded at the apex, base acutely cuneate to obtuse, 4–12 cm. long, 1–4 cm. broad, firmly membranaceous, the reticulate tertiary venation very prominent on both surfaces, glabrous; petioles 1.0–1.5 cm. long or somewhat less. Inflorescences clustered subterminally in the uppermost leaf axils, dichasial, relatively dense, gray-puberulent, 1–3 cm. long, the pedicels about 1 mm. long, the bracts minute. Calyx lobes broadly ovate, acute to rounded, 0.5–1.0 mm. long, appressed-pilosulose without. Corolla whitish or yellowish, densely appressed-puberulent to nearly glabrous without, the tube 2.5–3.0 mm. long, about 1 mm. broad at the insertion of the stamens, the lobes ovate, 0.5–1.5 mm. long. Stamens inserted somewhat above midway within the corolla tube, the anthers about 0.5 mm. long. Ovary ovoid, about 0.5 mm. long, densely puberulent. Follicles clavate-oblong, 3–6 cm. long and 1.0–1.5 cm. broad, very conspicuously lenticellate, the seeds 2–3.5 cm. long, the obtuse, basal wing about as long as the radially symmetric cotyledons.

Northern Colombia to Paraguay and northern Argentina and eastern Peru, in forests and thickets from approximately 25 to 1000 m. elev.; flowering from February to June in the north and from November to March in the south.

Vernacular names: *Carreto* (Colombia—Dugand); *Comulá* or *Cumulá* (Colombia—Killip et al.); *Paroba* and *Paroba mirim* (Brazil—Warming); *Peroba rosa* (Brazil—Whitford & Silveira); *Perobinha* (Brazil—Whitford & Silveira); *Peroba* and *Palo rosa* (Argentina—Denis).

COLOMBIA: ATLANTICO: Luruaco, *Dugand* 582 (COL), *Elias* 1597 (F, MO); near Barranquilla, *Dugand* 428 (F); Arroyo de Caña, *Dugand* & *Jaramillo* 2790 (COL), *Dugand* 355 (F, US), 208 (F); alrededores de Galapa y Baranoa, *Dugand* & *Jaramillo* 3442 (COL). BOLIVAR: Río Sinu, *Verken* & *Cambourg* s. n. (P). CUNDINAMARCA: Tocaima, *Arbelde* 4689 (COL, US); Chucunda-Tocaima, *Garcia* 3083 (COL, US); east of Apulo, along trail to Anapoima, *Killip*, *Dugand* & *Jaramillo* 38131 (COL, US); Hacienda El Cucharo, between Tocaima and Pubenza, *Killip*, *Dugand* & *Jaramillo* 38280 (COL, MO, US), *Jaramillo* & *Meja* 233 (COL). MAGDALENA: Tocaima, *Triana* s. n. (COL); near Fonseca, *Haught* 4007 (COL, US); Procedencia Fundacion, *Núñez Bossio* 541 (COL); Río Tucurínca, *Dugand* 1024 (COL, F); Don Jaca, Santa Marta Region, *Record* 66 (F).

BRAZIL: ESPIRITO SANTO: Collantina, *Whitford* & *Silveira* 62 (F, GH, US). MINAS GERAIS: Lagoa Santa, *Warming* s. n. (C, NY); locality lacking, *Regnell* 870 (F, NY). PARANÁ: Cachoerinha, *Whitford* & *Silveira* 125 (F, GH, US); Patrimonio, *Dusén* 16781 (GH, MO, NY, US); Jaguarihyva, *Dusén* s. n. (F, MO); Volta Grande, *Dusén* s. n. (GH). RIO DE JANEIRO: Morro Azul, *Riedel* 2332 (F, GH, NY, P, U, W); Floresta da Ulica, *Glaziov* 11189 (C, P); Botanical Gardens, *Whitford* 12 (GH, US); Mundo Novo, *Kublmann* 15344 (U, US); Matta da Fabrica Alianca, *Serviço Florestal* 103 (MO); Avelar, *Núñez* 9 (R). SÃO PAULO: Jardim Botânico, *Hoebne* 28669 (NY); Rio Claro, *Löfgren* 673 (C); São Paulo, *Beaurepaire* s. n. (R); locality lacking, *Löfgren* 32 (C), *Lund* s. n.



PARAGUAY: Sierra de Amambay, Hassler 10408 (W), 10408a (W).

ARGENTINA: MISIONES: Puerto Bertoni, Denis 3578 (MO).

PERU: CAJAMARCA: Prov. Jaen, near Las Huertas, Weberbauer 7115 (GH, US).

Professor Dugand, who has been particularly interested in this species, reports that it produces excellent structural timber, the heartwood being handsome pink or orange in color and the sapwood dull gray-white. From the reports of collectors, the trees appear to be evergreen, with rather scanty, watery sap and not milky. The leaves of specimens currently assigned to *A. Dugandii* appear to be somewhat larger than strictly typical *A. polyneuron*, and the corolla lobes may average a bit longer, but I do not consider these slight differences to be of specific importance.

17. *ASPIDOSPERMA CYLINDROCARPON* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:54. 1860;

M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: Sello s. n.!).

*Aspidosperma lagoense* Muell. Arg. in Kjoeb. Vidensk. Meddel. 102. 1869. (T.: Warming s. n.!).

*Aspidosperma brevifolia* Rusby, in Bull. N. Y. Bot. Gard. 8:113. 1912. (T.: R. S. Williams 255!).

*Aspidosperma cylindrocarpon* Muell. Arg. var. *genuinum* Hassl. in Fedde, Repert. 12:260. 1913.

*Aspidosperma cylindrocarpon* Muell. Arg. var. *longepetiolatum* Hassl. loc. cit. 261. 1913. (T.: Hassler 12068!).

*Aspidosperma cylindrocarpon* Muell. Arg. var. *macrophyllum* Hassl. loc. cit. 1913. (T.: Hassler 11422).

Trees 4–12 m. tall, the branches relatively slender, glabrous or irregularly puberulent when very young, thinly rimose at maturity. Leaves ovate- to lance- elliptic, acutely acuminate to obtuse, base obtuse to acute, 5–12 cm. long, 1.5–6.0 cm. broad, firmly membranaceous, lustrous, the reticulate tertiary venation emersed, glabrous; petioles 2.0–2.5 cm. long. Inflorescences clustered subterminally in the uppermost leaf axils, dichotomously dichasial, very lax, 2–7 cm. long, glabrous or rarely irregularly puberulent, the pedicels 1–3 mm. long, the bracts minutely lanceolate, caducous. Calyx lobes ovate, acute, 1 mm. long, glabrous or minutely ciliolate. Corolla white, glabrous or rarely indefinitely puberulent-papillate without, the tube 2–3 mm. long, about 1 mm. wide at the insertion of the stamens, the lobes narrowly oblong, 5–8 mm. long. Stamens inserted about midway within the corolla tube, the anthers about 0.5 mm. long. Ovary ovoid, about 0.5 mm. long, glabrous, the stigma subglobose. Follicles stoutly clavate-oblong, 6–8 cm. long and 2.0–2.5 cm. broad, very conspicuously lenticellate, the seeds 3–5 cm. long, the acute basal wing somewhat shorter than the bilaterally symmetric cotyledons or about as long.

Southern Brazil and adjacent Paraguay and Bolivia, in woodlands and balcony forests of plains; flowering from September to November.

Vernacular name: *Carapanhuba* (Brazil—Ducke).

BRAZIL: MATO GROSSO: Cáceres, Hoebne 4444 (MO), 5034 (R). MINAS GERAIS: entre Sitio & Barbacena, Glaziov 12948 (C, P); Arcos, Oliveira 211 (MO); Bello Hori-





Fig. 7. *Aspidosperma cylindrocarpon* Muell. Arg. (upper figures): Flowering branch, entire and dissected flowers; *Aspidosperma cuspa* (HBK.) S. F. Blake (lower figures): Flowering branch, entire and split fruit showing seed.

zonte, Magalhães 620 (MO); Lagoa Santa, Warming s. n. (C, F, W); Santa Luzia, Mello Barreto 3189 (F); Caldas, Regnell 870 bis (C, F, GH, K, NY, R, U, US); locality lacking, Regnell s. n. (F), Sello s. n. (P, W). PARANÁ: Jaguarahyva, ad marginem silvulae, Dusén 16071 (F, GH, MO, NY, US), ibid. in campo rupestre, Dusén s. n. (F, GH, MO). RIO DE JANEIRO: Aldeia de São Pedro, Glaziov 12952 (C, K, MO, P, R); São Pedro da Aldeia, Ule s. n. (R). SÃO PAULO: Loreto, Vecchi 264 (R).

PARAGUAY: Sierra de Amambay, Hassler [Rojas] 10590 (MO, W).

BOLIVIA: SANTA CRUZ: Tarochito, Steinbach 8144 (K, U); Río San Juan, R. S. Williams 255 (NY).

Although the inflorescence of this species typically is glabrous, occasional pubescence, combined with somewhat shortening of the corolla lobes, might be

interpreted as evidence of occasional hybridization with *A. polyneuron*. This is particularly noticeable in the Bolivian specimen cited above.

18. *ASPIDOSPERMA CUSPA* (HBK.) S. F. Blake, ex Pittier, Man. Pl. Us. Venez. 110. 1926.

*Conoria* ? *Cuspa* HBK. Nov. Gen. & Sp. 7:242. 1825. (T.: Humboldt & Bonpland s. n., photo. GH!).

*Alsodeia Cuspa* (HBK.) Spreng. Syst. 4:Cur. Post. 99. 1827.

*Aspidosperma Lbotzkianum* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:60. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:366. 1947. (T.: Lbotzky s. n., photo. MO!).

*Aspidosperma decipiens* Muell. Arg. in Linnaea 30:398. 1860; M. Pichon, loc. cit. 1947. (T.: Spruce 3617!).

*Aspidosperma sessiliflorum* Muell. Arg. loc. cit. 399. 1860. (T.: Sieber, Fl. Trin. 53!).

*Thyroma sessiliflorum* (Muell. Arg.) Miers, Apoc. So. Am. 23. 1878.

*Thyroma decipiens* (Muell. Arg.) Miers, loc. cit. 24. 1878.

*Thyroma Lbotzkiana* (Muell. Arg.) Miers, loc. cit. 25. 1878.

*Macaglia decipiens* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma domingense* Urb. Symb. Ant. 5:460. 1908. (T.: Eggers 2349).

*Aspidosperma lucentinervium* S. F. Blake, in Contr. Gray Herb. n. s. 53:46. 1918. (T.: Curran & Haman 970!).

*Aspidosperma elliptica* Rusby, Descr. So. Am. Pl. 82. 1920; M. Pichon, loc. cit. 1947. (T.: H. H. Smith 836!).

*Aspidosperma Lbotzkianum* Muell. Arg. var. *hypoplasium* Malme, in Arkiv Bot. 21A<sup>6</sup>:11. 1927. (T.: Malme 2745!).

*Aspidosperma Woronovii* Standl. in Field Mus. Publ. Bot. 8:34. 1930. (T.: Woronov 7075!).

Shrubs or trees 3–8 m. tall, the branches relatively slender, glabrous, or infrequently densely puberulent, thinly rimose at maturity. Leaves narrowly oblong-elliptic to broadly oval or ovate, apex obtuse or rounded, base broadly obtuse or rounded, 2–13 cm. long, 0.8–8.0 cm. broad, firmly membranaceous, yellowish-green, above glabrous, opaque or lustrous, beneath more or less glaucous, glabrous or infrequently more or less densely puberulent, the tertiary reticulate venation very prominent on both surfaces; petioles 2–9 mm. long. Inflorescences solitary, monochasial and rather thyriform, densely papillate or puberulent, 1–3 cm. long, terminal or less frequently apparently lateral and axillary or extra-axillary, the flowers sessile, the bracts 1–3 mm. long or less, persistent. Calyx lobes broadly ovate, obtuse, about 1 mm. long, papillate or minutely puberulent. Corolla greenish yellow or white, glabrous without, the tube 2.5–3.0 mm. long, about 1.5 mm. in diameter at the insertion of the stamens, the lobes broadly ovate, obtuse, about 1.0–1.5 mm. long. Stamens inserted somewhat above midway within the corolla tube, the anthers about 1 mm. long. Ovary ovoid, about 0.5 mm. long, glabrous, the stigma fusiform, about 0.3 mm. long. Follicles broadly or narrowly subreniform, acute or rounded at the tip, with a prominent midrib, 2–4 cm. long and 1–2 cm. broad, obviously lenticellate, glabrous or minutely papillate; seeds 2.0–3.5 cm. long and 1.0–1.5 cm. broad, the obtuse basal wing about as long as the bilaterally asymmetric cotyledons.

Colombia to southern Brazil; eastern Ecuador; Hispaniola and Trinidad. In arid thickets, light woodlands, and savannas; flowering intermittently throughout the year.

Vernacular names: *Carreto*, *Amargo* (Colombia—Dugand); *Vara de piedra* (Colombia—Bro. Elias); *Cuspa* (Venezuela—Humboldt, Steyermark); *Cuspa negra* (Venezuela—Steyermark); *Amargoso* (Venezuela—Curran & Haman).

HAITI: vicinity of Jean Rabel, *Leonard & Leonard* 12646 (MO, US); vicinity of Mole St. Nicolas, *Leonard & Leonard* 13351 (GH, NY, US); Massif des Mathieux, *Ekman* 6643 (US), 988 (US).

TRINIDAD: Pointe Gourde, *Britton & Broadway* 2648 (GH, NY, US); Gasparee Island, *Broadway* 9426 (U); Camaronaro, *Danouse* 6979 (MO, NY, US); locality lacking, *Siebert* 5 (MO, W).

COLOMBIA: ATLANTICO: Barranquilla, *Elias* 1419 (F, MO), *Dugand* 37 (F), 3138 (COL); Puerto Colombia, *Dugand* 632 (F, NY), *Dugand & Jaramillo* 3229 (COL, US). CUNDINAMARCA: Apulo, trail to Anapoima, *Killip*, *Dugand & Jaramillo* 38169 (COL, MO, US). GOAJIRA: Carraipia, *Haught* 4212 (US). HUILA: Quebrada de Angeles to Río Cabrera, *Rusby & Pennell* 335 (GH); Quebrada de Mambucá, *Woronow* 7075 (F). MAGDALENA: Santa Marta, *H. H. Smith* 836 (F, GH, MO, NY, U, US), *Esquina* 28 (F, MO), *Record* 66 bis (GH, NY), 81 (F); Bonda, *Castañeda* 135 (COL, MO); Municipio Baraya, *Caicedo* 12434 (COL).

VENEZUELA: AMAZONAS: Maypures, *Spruce* 3617 (NY, W). ANZOATEGUI: Guanta, *Curran & Haman* 1211 (GH, NY, US). ARAGUA: Maracay, *Pittier* 11362 (G, GH, NY, US). CARABOBO: Valencia, *Pittier* 9042 (GH, NY, US), 8708 (GH, NY, US). DISTRITO FEDERAL: between La Guaira and Río Grande, *Curran & Haman* 970 (GH, NY); La Guaira, *Curran & Haman* 840 (US), 938 (US); Curucutí, *Pittier* 10214 (GH, NY, US). FALCON: Paraguana Pen., *Curran & Haman* 586 (F, GH, MO, NY, US). MERIDA: Colonia Tovar, *Fendler* 1299 (GH—in part, K). SUCRE: southern slopes of Cerro Imposible, *Steyermark* 62819 (F, MO, NY, US); La Toma, *Steyermark* 62849 (F, MO). STATE UNKNOWN: Cabo Blanco, *Curran & Haman* 907 (GH, US), 938 (GH), 940 (GH, NY, US), 954 (GH), 955 (GH, NY); Camburi Chiquito, *Curran & Haman* 840 (GH, NY, US), 923 (GH, US); Río Caribe, *Curran & Haman* 1260 (GH, NY, US); Cristobal Colon, *Broadway* 62 (GH, NY, US), 962 (NY, US).

BRAZIL: BAIA: locality lacking, *Luetzelburg* 209 (NY). CEARÁ: locality lacking, *Lund s. n.* (C), *Allemão* 968 (MO, P, R). GOIAZ: Goiaz, *Burchell* 7348 (K). MATO GROSSO: Corumba, *Malme* 2745 (G, S, US), 2745a (S, US); Cuyabá, *Malme* 2567 (NY, US). PARAÍBYBA: S. Gonzalo, *Luetzelburg* 26959 (NY). RIO DE JANEIRO: Cabo Frio, *Glaziou* 11185 (C, P).

ECUADOR: EL ORO: between Portovelo and Río Cabra, *Steyermark* 54085 (F, MO, NY).

This is an extremely distinctive species which shows no indications of intergradation with its congeners. At the same time, it is extremely variable, particularly in leaf size, color, and indument or lack of it. The most outstanding of these variants are *A. Woronowii* (densely puberulent), *A. domingense* (unusually small leaves of rather heavy texture), and *A. Lbotzkiana* (inflorescences axillary or extra-axillary some distance from the apical meristem). These variants intergrade, however, and I do not believe that our present knowledge is sufficient even to recognize them as varieties.

An interesting aspect of *A. cuspa* is shown by the *Luetzelburg* specimen from Baía and the *Burchell* specimen from Goiaz, which show the juniper-like deforma-

tion of the inflorescence so common in species of Series NITIDA. Burchell explains this by the remark "*insectis deformat*". I am inclined to interpret this abnormality as a physiological character supporting the morphological affinity of Series POLYNEURA and NITIDA which I first assumed from morphological grounds.

SERIES V. RIGIDA Woodson, n. ser.

- § *Tetrasticha* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:363. 1947, in part;  
§ *Glabriflora* M. Pichon, loc. cit. 1947, in part; § *Piliflora* M. Pichon, loc. cit. 364.  
1947, in part.

Tall trees, apparently evergreen, with rather close, thin, conspicuously lenticellate bark. Branches with naked, obtuse buds, the subtending internode somewhat thicker than the terminal petiole, without definite seasonal articulations. Leaves alternate, firmly membranaceous, moderately large, with rather indistinct, widely arcuate secondary venation. Inflorescence subterminal, dichotomously cymose, with persistent but irregularly disposed and frequently obscure bracts; corolla salverform, the lobes reflexed but the tube not definitely constricted at the orifice, somewhat coriaceous, glabrous without; ovary polygonally angulate. Follicles very broadly dolabriform, nearly circular, the placenta rotating about 300°, sessile, smooth, with or without a prominent midrib, glabrous, inconspicuously lenticellate; seeds with a concentric, nearly circular wing.

*Species 19*

Figure 8.

19. *ASPIDOSPERMA RIGIDUM* Rusby, in Mem. N. Y. Bot. Gard. 7:323. 1927 (as *rigida*). (T.: Rusby 593!).

*Aspidosperma rauwolfioides* Mg. in Notizbl. 12:300. 1935. (T.: Steinbach 8129!).

*Aspidosperma acreanum* Mg. loc. cit. 15:133. 1940. (T.: Ule 9701!).

*Aspidosperma laxiflorum* Kuhl. in Anais Prim. Reun. Sul-Am. Bot. 3:88, t. 17. 1940. (T.: Ducke 22438!).

*Aspidosperma subumbellatum* Kuhl. loc. cit. 1940. (T.: Ducke 24577!).

Trees 8-40 m. tall, the branches relatively slender, glabrous. Leaves ovate-oblong-elliptic, apex subcaudate-acuminate, base broadly decurrent to the petiole, 6-15 cm. long, 2-6 cm. broad, firmly membranaceous, opaque, glabrous; petioles 0.5-1.5 cm. long. Inflorescence either terminal or lateral to the leafy branches, or both, 3-4 cm. long, dichotomously cymose, more or less appressed-pilosulose, inconspicuously bracteate, the pedicels 2-3 mm. long. Calyx lobes ovate, acute to obtuse, 1.0-1.5 mm. long, minutely tomentellous without. Corolla greenish-white, wholly glabrous without, the tube 2-3 mm. long, the lobes reflexed, oblong-elliptic, 5-7 mm. long. Stamens inserted about midway within the corolla tube, the anthers somewhat less than 1 mm. long. Ovary oblongoid, glabrous, about 1 mm. long, the stigma minutely capitate. Follicles nearly circular, 3.0-4.5 cm. in diameter, sessile or very shortly stipitate, smooth, glabrous, with a very excentric midrib; seeds circular or broadly oval, about 4 cm. in diameter.



Fig. 8. *Aspidosperma rigidum* Rusby: Flowering branch, bud, dissected flower, and fruit.

Eastern Bolivia and neighboring Brazil, in forests (*varzea* and *terra firma*); flowering from July to October.

Vernacular name: *Carapanabuba* (Brazil—Krukoff, Ducke).

BRAZIL: AMAZONAS: near mouth of Rio Embira, *Krukoff* 5172 (G, MO, S, U, US); Municip. Humayta, *Krukoff* 6224 (MO, U, US), 6398 (MO, U, US); Rio Solimoes, em frente als. Paulo de Olivença, *Ducke* 24577 (MO). ACRE: near mouth of Rio Macaúhan, *Krukoff* 5642 (MO); Seringal Oriente, *Kublmann* 498 (US); Seringal Monte Mo, *Ule* 9701 (K). PARÁ: Rio Tapajós, *Ducke* 22438 (MO).

BOLIVIA: LA PAZ: Bopi River valley, *Rusby* 593 (NY); Province of S. Yungas, basin of Río Bopi, *Krukoff* 10148 (MO, U, US), 10170 (MO, U, US). SANTA CRUZ: Jorochito, *Steinbach* 8129 (F, GH, K, S).

Krukoff reports that the timber of this species is of excellent quality.

## SERIES VI. NITIDA Woodson, n. ser.

Ser. *Macrolobii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895, in part; Ser. *Microlobii* K. Sch. loc. cit. 142. 1895, in part; § *Piliflora* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947, in part; § *Macrantha* M. Pichon, loc. cit. 1947, in part; § *Laevifolia* M. Pichon, loc. cit. 365. 1947.

Trees with milky latex and conspicuously sulcate or lamellate boles, apparently evergreen, with tight dense bark but usually conspicuously lenticellate. Branches with naked, acuminate buds, the subtending internode scarcely thicker than the terminal petiole and the bud thus appearing pseudo-lateral, without definite seasonal articulations and with the uppermost internodes not definitely shortened. Leaves alternate, usually more or less coriaceous, frequently revolute-auriculate at the base. Inflorescence terminal or subterminal, thyrsiform or cymiform, with persistent but irregularly disposed and more or less evident bracts; corolla tubular or rubular-salverform, rather coriaceous, densely sericeous without, the lobes erect or ascending at anthesis, the tube not constricted at the orifice; ovary glabrous or sericeous, polygonally angulate or sulcate; calyx lobes 5, abnormally 4, distinct or barely united at the base, equally or very strongly unequal. Follicles very broadly dolabriform, concave-convex to very unequally bi-convex, the placenta rotating about 225°-300°, broadly warty to spiny, sessile or very abruptly and shortly stipitate; seeds with a concentric circular wing.

*Species 20-33*

Figure 9.

## KEY TO THE SPECIES

- a. Corolla about 1.0-2.5 cm. long.
  - b. Corolla lobes 2-3 times as long as the tube.
    - c. Corolla about 2.5 cm. long; inflorescence conspicuously bracteate, densely brown-tomentellous; leaves moderately coriaceous, the secondary venation obvious..... 20. *A. INUNDATUM*
    - cc. Corolla about 1.3 cm. long; inflorescence inconspicuously bracteate, finely sulphur-tomentellous; leaves very heavily coriaceous, the secondary venation almost completely immersed..... 21. *A. SCHULTESII*
  - bb. Corolla lobes about as long as the tube to about half as long or less.
    - c. Corolla lobes oblong, about as long as the tube; leaves oblong to obovate-oblong, broadly rounded at the base, gray-papillate beneath.
      - d. Leaves heavily coriaceous, highly lustrous above; inflorescence terminal; corolla 1.5-1.6 cm. long..... 22. *A. MEGAPHYLLUM*
      - dd. Leaves membranaceous or chartaceous, opaque above; inflorescence lateral; corolla about 1.2 cm. long..... 23. *A. MYRISTICIFOLIUM*
    - cc. Corolla lobes ovate, about half as long as the tube or somewhat less; leaves elliptic, acute to obtuse at the base, yellow-tomentellous beneath..... 24. *A. CARAPANAUBA*
- aa. Corolla 0.3-0.8 cm. long.
  - b. Inflorescence terminal to the leafy shoot.
    - c. Leaves not conspicuously revolute-auriculate at the base.
      - d. Leaves usually broadest at about the middle or below, obtuse or rounded at the base, the secondary veins of about 14-20 pairs, relatively distant.
        - e. Leaves ovate- to oblong-elliptic, acute to obtuse at the tip, opaque or slightly lustrous above, microscopically papillate to essentially glabrous beneath; flowers immediately subtended by bracteoles; follicles abruptly constricted to a short stipe..... 25. *A. MARCGRAVIANUM*
        - ee. Leaves broadly oval or ovate, rounded to emarginate at the tip, highly lustrous above, densely velutinous-papillate beneath; flowers distinctly pedicellate; follicles sessile..... 26. *A. EXCELSUM*
      - dd. Leaves usually broadest above the middle, narrowly cuneate at



- the base, highly lustrous above, the secondary veins almost innumerable and closely crowded; flowers distinctly pedicellate..... 27. *A. EBURNEUM*
- cc. Leaves conspicuously revolute-auriculate at the base.
- d. Inflorescence dichotomously cymose, the peduncles shorter than the subtending petioles or scarcely longer; leaves rather narrowly oblong-elliptic; indument gray..... 28. *A. OBLONGUM*
- dd. Inflorescence thyriform, the peduncles much longer than the subtending petioles.
- e. Leaves broadly elliptic to oval, 4–8 cm. long, broadly obtuse to rounded at the tip; calyx lobes very unequal; indument gray..... 29. *A. DISCOLOR*
- ee. Leaves elliptic-ovate to lanceolate, 6–12 cm. long, acute to acuminate at the tip; calyx lobes equal to somewhat unequal; indument brown..... 30. *A. SALGADENSE*
- bb. Inflorescence lateral to the leafy shoot.
- c. Leaves oval to broadly elliptic, the tip obtuse to abruptly and shortly acuminate.
- d. Leaves not revolute-auriculate at the base; inflorescence greatly condensed, the primary peduncle much shorter than the subtending petiole..... 31. *A. NITIDUM*
- dd. Leaves revolute-auriculate at the base; inflorescence rather lax, the primary peduncle about as long as the subtending petioles or somewhat longer..... 32. *A. AURICULATUM*
- cc. Leaves narrowly elliptic to elliptic-lanceolate, gradually and acutely subcaudate-acuminate, revolute into a narrowly cuneate base..... 33. *A. PICHONIANUM*
20. *ASPIDOSPERMA INUNDATUM* Ducke, in Archiv. Jard. Bot. Rio Janeiro 3:245. 1922; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:364. 1947. (T.: *Ducke 17195!*).

*Aspidosperma acanthocarpum* Mgf. in Notizbl. 14:128. 1938. (T.: *Ducke 24569!*).

Trees of moderate height, the branches rather stout, densely ferruginous-tomentellous when young, becoming glabrate. Leaves ovate to broadly oblong-elliptic, apex broadly acute to shortly acuminate, base obtuse, 7–16 cm. long, 2.5–7 cm. broad, glabrous and somewhat lustrous above, densely and minutely brown-tomentellous beneath; petioles 1.5–2.0 cm. long. Inflorescence both terminal and lateral to the leafy branches, stout, corymbose-thyriform, 4–9 cm. long, conspicuously bracteate, densely brown-tomentellous, the pedicels about 2 mm. long. Calyx lobes broadly ovate, acute, 2.5–3.0 mm. long, densely and minutely brown-tomentellous without. Corolla white, densely tomentellous without, the tube about 9 mm. long and 2.5 mm. thick at the insertion of the stamens, the lobes narrowly lanceolate-elliptic, 1.5–1.6 cm. long. Stamens inserted somewhat above midway within the corolla tube, the anthers about 2 mm. long. Ovary ovoid, about 2 mm. long, densely tomentellous, the stigma narrowly cylindric. Follicles nearly circular, 3.5–4.0 cm. in diameter, with a short stout stipe about 0.5 cm. long, densely and stoutly spinose; seeds circular, 3–4 cm. in diameter.

Amazon valley, in forests; flowering during August and September.

Vernacular names: *Carapanaúba* and *Maparaná* (Ducke).

BRAZIL: PARÁ: Gurupa, silva ab Amazonum fluvio inundata, *Ducke 17195* (P, U, US); ad orientem lacus Salgado prope flumen Trombetas, *Ducke 21808* (P, U, US); Gurupá, *Ducke 15814* (MO). AMAZONAS: São Paulo de Olivença, Rio Solimões, *Ducke 24569* (U, US).

It is somewhat doubtful whether *A. inundatum* and *A. acanthocarpum* actually are conspecific. *Ducke 24569*, which bears stoutly spiny fruits, also bears stout inflorescences which clearly indicate the plant to be of this affinity; however, they are much too young to show floral structure. In describing *A. inundatum*, *Ducke* describes the fruit in detail, but does not mention them as being spiny; a fruit which accompanies *Ducke 17195* in the United States National Herbarium is too old and badly decomposed for accurate analysis.

21. *ASPIDOSPERMA Schultesii* Woodson, spec. nov.

Arbor alta; ramulis crassiusculis nigris juventate minute pilosulis tandem glabris. Folia alternata longissime petiolata lamina elliptica vel oblongo-elliptica apice obtusiuscula basi et in petiolo late decurrente 12–15 cm. longa 5–6 cm. lata rigidissime coriacea supra illustri venis secundariis emersis subtus pallida et minute denseque sulfureo- vel griseo-tomentella; petiolis crassiusculis nigris ca. 4 cm. longis. Inflorescentiae terminales vel subterminales dichotome cymosae ca. 6 cm. longae minute sulfureo-puberulae; pedunculis graciliusculis; bracteis vix bene visis; pedicellis ca. 1 mm. longis. Calycis laciniae subaequales late ovatae acutae 1.5–2.0 mm. longae extus minute sulfureo-tomentellae. Corolla lutea extus plus minusve sulfureo-pilosa; tubo ca. 3 mm. longo ca. 1.5 mm. diam.; lobis oblongo-lanceolatis ca. 10 mm. longis. Antherae ca. 0.6 mm. longae. Ovarium depresso sphaericum longitudinaliter sulcatum ca. 0.5 mm. longum dense tomentellum; stigmatibus ovoidibus apiculato. Fructus ignoti.

BRAZIL: AMAZONAS: path between headwaters of Ira-Igarapé and headwaters of Igarapé Abiú, affluent of Rio Taraira, July 4–6, 1948, R. E. Schultes & F. López 10178 (MO, HOLOTYPE).

This is such an unusual species that it is indeed unfortunate that the fruit is not known. The flowering specimen somewhat suggests the series NOBILES in the black, obscurely lenticellate branches, heavily coriaceous leaves, and somewhat fastigate inflorescences. To judge from stains upon the leaves, I suspect that the latex may be red, as well; although Dr. Schultes states that it is white.

22. *ASPIDOSPERMA megaphyllum* Woodson, spec. nov.

Arbor ca. 15 m. alta; ramulis crassiusculis juventate dense ferrugineo-papillatis mox glabris cortice saturate fusco firmo striato haud evidenter lenticellato. Folia magna rigide coriacea lamina late oblonga apice latissime obtusa vel rotundata basi late rotundata 15–25 cm. longa 9–15 cm. lata supra valde illustri subtus pallida et dense griseo-papillata; petiolo nigro glabro 1.5–2.0 cm. longo. Inflorescentia terminalis dichotome cymosa repetite ramosa ca. 7–8 cm. longa dense ferrugineo-papillata; pedunculis crassiusculis; bracteis inconspicuis; pedicellis ca. 2 mm. longis. Calycis laciniae 4 (vel 5?), valde imbricatae inaequales exteriores late subreniformes rotundatae 4.0–4.5 mm. longae 5–6 mm. latae, interiores suborbiculares

ca. 4 mm. diam., omnes dense ferrugineo-papillatae. Corolla extus dense ferrugineo-tomentella; tubo ca. 7–8 mm. longo 3.5–4.0 mm. lato; lobis late oblongo-ellipticis ca. 8 mm. longis. Antherae ca. 2 mm. longae. Ovarium depresso subsphaericum ca. 1.5 mm. altum dense ferrugineo-hirtellum. Fructus ignoti.

BRAZIL: ACRE: near mouth of Rio Macauhan, tributary of Rio Yaco, on terra firma, August 24, 1933, *Krukoff 5639* (K, MO, HOLOTYPE, NY, U).

Although referred to *Geissospermum excelsum* Kuhl. (*Aspidosperma carapanauba* M. Pichon) by Markgraf, and undoubtedly closely related to it, I believe that the two species are sufficiently distinct.

23. *ASPIDOSPERMA myristicifolium* (Mgf.) Woodson, comb. nov.

*Geissospermum* (?) *myristicifolium* Mgf. in Notizbl. 11:787. 1933. (T.: Ruiz & Pavon, s. n.!).

*Aspidosperma elatum* E. L. Little, in Jour. Wash. Acad. Sci. 38:105, fig. 19. 1948. (T.: Little 6517!).

Trees up to 35 m. tall, with sulcate trunks as much as 1 m. in diameter, the branches relatively slender, very minutely appressed brown-pilosulose when young, soon becoming glabrate and rather conspicuously lenticellate. Leaves obovate-oblong, apex obtuse to shortly acute, base rounded to subtruncate, 20–25 cm. long and 7–10 cm. broad, firmly membranaceous, essentially glabrous, opaque above, beneath paler and with the relatively distant secondary veins very prominent, the tertiary venation immersed; petioles rather stout, 1.0–1.5 cm. long. Inflorescence axillary, dichasial, many-flowered, brown-tomentellous. Calyx lobes orbicular, about 2 mm. long, brown-tomentellous. Corolla densely brown-tomentellous without, the tube about 6 mm. long and 2 mm. broad, the lobes oblong, about 6 mm. long and 2 mm. broad. Stamens inserted about midway within the corolla tube, the anthers somewhat more than 0.5 mm. long. Ovary globose, about 1 mm. long, densely white-pilosulose. Follicles very broadly dolabriform, subplano-convex, sessile, about 11–12 cm. long and broad, very densely brown-velutinous; seeds with a circular concentric wing about 10 cm. in diameter.

Western Ecuador, in forests.

Vernacular names: *Naranjo* (Ruiz & Pavon); *Naranjo de monte* (E. L. Little).

ECUADOR: GUAYAS: Guayaquil, Ruiz & Pavon s. n. (MO). LOS RIOS: Pichilingue, E. L. Little 6517 (MO, US).

The discovery of the fruits and seeds of this species by Dr. Little verifies Pichon's opinion of its systematic position (in Bull. Mus. Nat. Hist. Nat. II, 19:368. 1947).

24. *ASPIDOSPERMA CARAPANAUHA* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1948. (Based on the succeeding:)

*Geissospermum excelsum* Kuhl. in Archiv. Inst. Biol. Veg. Rio Jan. 2:89, pl. 7. 1935, non *Aspidosperma excelsum* Benth. (T.: Ducke 24471!).

Large trees, the branches relatively stout, dark brown to black, minutely ferruginous-papillate when young, becoming glabrate with a close bark without apparent lenticels. Leaves broadly elliptic to oblong-elliptic, obtuse to abruptly and shortly acuminate, base acute to obtuse, 10–20 cm. long, 4–8 cm. broad, coriaceous, above minutely yellow-papillate to glabrate and lustrous, densely and minutely yellow-tomentellous beneath; petioles 1.5–2.0 cm. long. Inflorescence lateral to the young leafy shoots, dichotomously cymose, 5–6 cm. long, densely yellow-tomentellous, the peduncles rather stout, the bracts inconspicuous, the pedicels about 1 mm. long. Calyx lobes 5, broadly ovate, broadly acute to obtuse, 2.5–3.0 mm. long, densely and minutely yellow-tomentellous. Corolla white, densely yellow-tomentellous without, the tube 7.5–8.0 mm. long, about 3 mm. broad, the lobes ovate, about 3 mm. long. Stamens inserted within the upper third of the corolla tube, the anthers about 1.3 mm. long. Ovary broadly oblong-ovoid, densely yellow-tomentellous, about 2 mm. long. Fruits unknown.

Central Amazon valley, in forests of high land; flowering in September.

Vernacular name: *Carapanauba* (Ducke).

BRAZIL: AMAZONAS: circa lacum Uaicurapá, prope Parintins, *Ducke 24471* (P, U).

Ducke cites the type specimen as *no. 24491*, apparently a typographical error.

25. *ASPIDOSPERMA Marcgravianum* Woodson, spec. nov.

Arbor magna 20–60 m. alta; ramulis graciliusculis glabris cortice fusco valde lenticellato. Folia ovato- vel oblongo-elliptica apice acuta vel obtusa basi late obtusa vel rotundata 6–14 cm. longa 2–5 cm. lata crasse membranacea supra opaca glabra subtus minutissime papillata vel glabra; petiolis 0.8–2.0 cm. longis. Inflorescentiae terminales thyrsiformes 3–6 cm. longae minute puberulae; pedunculis graciliusculis; bracteis minimis; floribus sessilibus. Calycis laciniae inaequales ovatae vel late oblongo-ovatae obtusae 2–3 mm. longae extus minute tomentellae bracteolis minimis 2–3 subtendentibus. Corolla virescens extus minute appressotomentella; tubo ca. 5 mm. longo ca. 1.5 mm. lato; lobis ovatis acutis ca. 1.5 mm. longis. Antherae prope ostio corollae tubae insertae ca. 0.6 mm. longae. Ovarium ovoideum longitudinaliter sulcatum ca. 1 mm. longum glabrum; stigmatibus fusiformi ca. 1 mm. longo. Folliculi fere orbiculares breviter stipitati 4–6 cm. diam. valde verrucosi, stipite ca. 0.5–1.5 cm. longo; seminibus 4–6 cm. diam.

Surinam and northern Brazil to eastern Bolivia; forests in terra firma; flowering from August to October.

Vernacular names: *Parelbout* and *Witte parelbout*, *Apukuíta* (Surinam—Boschwezen; *Carapanauba* (Brazil—Ducke, Krukoff); *Cipóal* (Brazil—Krukoff).

SURINAM: Kaboerie, *Boschwezen 5069* (NY, U, US); Brownsberg, *Boschwezen 1751* (U); Sanderij F, *van Niel 6224* (U), *Boschwezen 1424* (U), *Archer 2775* (US); Sectie O, *Boschwezen 1354* (U), *6395* (U, US).

BRAZIL: AMAZONAS: Municip. Humayta, near Livramento, *Krukoff 6843* (MO, US), *7207* (K, MO); Municip. São Paulo de Olivença, basin of Rio Solimões, *Krukoff 12150* (NY, US); Manáos, *Ducke 1163* (MO, NY, US). PARÁ: Belém, Bosque Municipal,

*Ducke 1263* (MO, HOLOTYPE, US); Haut Ariramba (Trombetas), *Ducke 14900* (US); Gurupo, *Ducke 17224* (US).

BOLIVIA: LA PAZ: Province of Larecaja, Tuirí, near Mapiri, *Krukoff 10833* (U, US), *10872* (MO, U, US); Tumupasa, *Cárdenas 1980* (K, NY).

The majority of these specimens have been referred to previously as *A. nitidum*. Not only the position, but also the relative size of the inflorescences, as well as the shape, size, and general aspect of the foliage, however, demonstrate that *A. Marcgravianum* is abundantly distinct from *A. nitidum*.

The inflorescences of many of the specimens cited above have been deformed, perhaps by insects, into an enlarged witches-broom affair in which all the floral parts have become calyx-like: the whole resembling a small branch of juniper. This disease also was noted in two specimens of *A. cuspa*.

26. *ASPIDOSPERMA EXCELSUM* Benth. in Hook. Jour. Bot. 3:245. 1841; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Schomburgk 468!*).

*Macglia excelsa* (Benth.) O. Ktze. Rev. Gen. 2:416. 1891.

Trees 15–35 m. tall, the branches moderately stout, essentially glabrous, at maturity with dark, rather indefinitely lenticellate bark. Leaves broadly oval to ovate, the tip broadly rounded to emarginate, base broadly obtuse to rounded, 7–12 cm. long, 3.5–7 cm. broad, heavily coriaceous, glabrous and highly lustrous above, pale and densely velutinous-papillate beneath; petioles 1–2 cm. long. Inflorescence terminal, corymbi-thyriform, about 5 cm. long, inconspicuously puberulent-papillate, the peduncles rather stout, branching repeatedly, the bracts rather inconspicuous, the pedicels 2–3 mm. long. Calyx lobes subequal, broadly ovate, obtuse to broadly acute, about 2 mm. long, densely tomentellous-papillate. Corolla greenish-white, tomentellous-papillate without, the tube about 3 mm. long and 1.5 mm. broad, the lobes ovate, acute, about 1.5 mm. long. Anthers about 0.6 mm. long. Ovary ovoid, sulcate, about 1 mm. long, glabrous. Follicles broadly oval strongly spinose-verrucose, 5.5–9.0 cm. long and 5–6 cm. broad, sessile.

British Guiana and Surinam, in "various types of forest [Sandwith]"; flowering from June to September.

Vernacular names: *Paddlewood* (British Guiana—Schomburgk, Archer); *Yaruru* (British Guiana—Tutin); *Wit parelbout* (Surinam—Boschwezen).

BRITISH GUIANA: Moraballi Creek near Bartica, *Sandwith 321* (NY, U); Tuicama Suri, *Laekie 2037* (F); upper Mazaruni River, *Leng 279* (NY); Bartica-Potaro Road, *Tutin 233* (US); Macouri Creek, Essequibo River, *Archer 2483* (US); locality lacking, *Schomburgk 468* (W).

SURINAM: fluv. Maratukka, *Stabel & Gonggrijp 944* (U).

Schomburgk noted that the narrow buttresses of this species prevented use of the timber for most purposes except the making of paddles; Tutin and Sandwith note that this practice is continued to the present day.



27. *ASPIDOSPERMA EBURNEUM* F. Allem. ex Sald. in Ann. Sci. Nat. V, 19:213, 1874; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Glazion* 6046!).

*Aspidosperma pruinatum* Mg. in Notizbl. 15:133. 1940. (T.: *Glazion* 12076!).

*Aspidosperma compactinervium* Kuhl. in Anais Prim. Reun. Sul-Am. Bot. 3:87, t. 16. 1940. (T.: *Machado Nunes* 26972).

Tall trees about 20 m. in height, the branches relatively slender, essentially glabrous, with reddish-brown, clearly lenticellate bark. Leaves narrowly elliptic to elliptic-obovate, apex shortly subcaudate-acuminate to acute or rounded, base rather narrowly cuneate, 6–8 cm. long, 1.5–3.5 cm. broad, moderately coriaceous, olive-green and highly lustrous above with almost innumerable, ascending, closely crowded secondary veins, paler and minutely papillate beneath; petioles about 1 mm. long. Inflorescence terminal, thyriform, 2–3 cm. long, inconspicuously appressed-pilosulose, the peduncles rather slender, the bracts inconspicuous, the pedicels about 1 mm. long. Calyx lobes more or less unequal, ovate, acute, about 2 mm. long, tomentellous-papillate. Corolla greenish-white, minutely tomentellous without, the tube about 4 mm. long and 1.5 mm. broad, the lobes oblong-ovate, about 3 mm. long. Anthers about 1 mm. long, inserted at about midway within the corolla tube. Ovary ovoid, sulcate, about 0.7 mm. long, glabrous. Follicles nearly circular, about 3.0–3.5 cm. in diameter, with a stipe about 0.5 cm. long, with rather low, widely spaced warts.

Southeastern Brazil in forests; flowering from August to October.

Vernacular names: *Pequia-marfim* (Glazion, Saldanha); *Pequia amarela* (Saldanha); *Peroba de gomo* (Mello Barreto).

BRAZIL: DISTRITO FEDERAL: Rio de Janeiro, *Glazion* 638 (C, P). RIO DE JANEIRO: floresta de la Tijuca, *Glazion* 6046 (C, P), 12076 (C, P). MINAS GERAIS: Belo Horizonte, *Mello Barreto* 10005 (F); *Avellar, Kublmann* 37745 (MO).

Saldanha cited no specimens in describing *A. eburneum*, but gave the locality as "montagne de Tijuco". The original label of *Glazion* 6046 bears the pencilled note "Tijuco" and the date 1870, and for this reason I have chosen that specimen as the provisional lectotype.

28. *ASPIDOSPERMA OBLONGUM* A.DC. in DC. Prodr. 8:399. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Martin s. n.*!).

*Macaglia oblonga* (A.DC.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma Kublmannii* Mg. in Notizbl. 12:555. 1935. (T.: *Kublmann* 22453).

Trees as much as 35 m. tall, with rather slender branches closely yellowish-gray puberulent when young, soon becoming glabrate with a close black, conspicuously lenticellate bark. Leaves narrowly oblong to rather broadly elliptic-oblong, apex acute to rather shortly and obtusely acuminate, base subtruncate and conspicuously revolute-auriculate, 7–14 cm. long and 2–4 cm. broad, firmly membranaceous, above opaque to somewhat lustrous, glabrous or glabrate at maturity, beneath pale



and minutely gray-papillate; petioles 0.5–2.0 cm. long. Inflorescence terminal, dichotomously cymose, 2–3 cm. long, densely gray-puberulent, conspicuously bracteate, the pedicels about 1 mm. long. Calyx lobes subequal, ovate, obtuse, about 1 mm. long, grayish tomentellous-papillate. Corolla greenish-white, densely and finely gray-tomentellous without, the tube about 3 mm. long, the lobes oblong-ovate, about 1.5 mm. long. Anthers about 1 mm. long, inserted about midway within the corolla tube. Ovary ovoid, tomentellous, about 1 mm. long. Follicles broadly oval to nearly circular, 4–6 cm. long, 3.5–5.0 cm. broad, verrucose, with a stipe about 0.5 cm. long.

Guiana (and western Brazil?), in *mora* and mixed forest; flowering in September and October.

Vernacular names: *Zwart parelbout* and *Jaroro kbaremeroe* (Surinam—Boschwezen).

BRITISH GUIANA: Kamuni Creek, Groete Creek, Essequibo River, Maguire & Fanshawe 22832 (F, GH, MO, NY, U, US).

SURINAM: Sectie O, Boschwezen 4830 (NY, U, US), Stabel 70 (U).

GUIANE FRANCAISE: Maroni, Wackenheim 133 (P); locality lacking, Poiteau s. n. (G, GH, W), Martin s. n. (P), Benoist 963 (P).

I have not seen the type specimen of *A. Kublmannii*, but the description of the fruiting branches contains nothing which does not apply to *A. oblongum*. *Kublmann* 22453 was collected in western Mato Grosso near the Bolivian border, however, and would thus enlarge the known distribution of the collective species greatly. Without inflorescence final disposition of *A. Kublmannii* is impossible.

29. *ASPIDOSPERMA DISCOLOR* A.DC. in DC. Prodr. 8:398. 1844; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Blanchet* 3388!).

*Aspidosperma Francisii* A.DC. loc. cit. 1844. (T.: *Blanchet* 2859!).

*Aspidosperma discolor* A.DC.  $\beta$ . *parvifolium* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:60. 1860. (T.: *Blanchet* 2859!).

*Macaglia discolor* (A.DC.) O. Ktze. Rev. Gen. 2:416. 1891.

Trees as much as 20 m. tall, the branches moderately slender, minutely gray-papillate when young, soon becoming glabrate and with dark brown, irregularly lenticellate bark. Leaves broadly elliptic to oval, apex obtuse to rounded, base broadly rounded or abruptly cuneate and revolute-auriculate, 4–8 cm. long and 2–3 cm. broad, firmly membranaceous to moderately coriaceous, glabrous and olive-green above, pale and densely gray-papillate beneath; petioles 0.7–1.0 cm. long. Inflorescence terminal, corymbi-thyriform, 5–7 cm. long, the peduncles minutely puberulent-papillate, branching repeatedly, the bracts rather conspicuous, the pedicels about 1 mm. long. Calyx lobes very strongly unequal, 2.0–3.5 mm. long, tomentellous-papillate. Corolla greenish-white, densely tomentellous without, the tube about 4–5 mm. long and 2 mm. broad, the lobes ovate, about 3 mm. long. Anthers about 1.5 mm. long, inserted within the upper third of the corolla. Ovary ovoid, about 1.5 mm. long, hirtellous. Follicles broadly oval, about 6 cm. long and 4 cm. broad, spiny-verrucose.

Eastern Brazil, in forests.

Vernacular names: *Quina de rego* (Froes); *Cabo de machado* (Ducke).

BRAZIL: BAÍA: Igreja Velha, *Blanchet* 3388 (NY, W); Serra Acurua, *Blanchet* 2859 (NY, W); Jacobina, *Blanchet* 3761 (P); Ibyguara, Serra Sincora, *Froes* 4 (NY). PERU: NAMBUCO: Recife, *Ducke* 2230 (MO).

Froes reports that the bark is very bitter and is used in treatment of malaria.

30. *ASPIDOSPERMA SALGADENSE* Mgf. in Notizbl. 12:554. 1935. (T.: *Ducke* 22456!).

Trees as much as 30 m. tall, the branches relatively slender, densely grayish yellow-papillate when young, becoming glabrate and with dark brown, conspicuously lenticellate bark at maturity. Leaves ovate- to lanceolate-oblong, apex obtuse to abruptly acute, base broadly obtuse and revolute-auriculate, 6–12 cm. long and 2–5 cm. broad, moderately coriaceous, glabrate and rather lustrous above, densely yellowish gray-papillate beneath; petioles 0.5–1.5 cm. long. Inflorescence thyrsiform, 5–6 cm. long, densely yellowish gray-papillate, the peduncles rather stout, branching repeatedly and monochasially, the bracts conspicuous, the pedicels about 1 mm. long. Calyx lobes more or less unequal, broadly ovate, obtuse, 1.5–2.0 mm. long, grayish tomentellous-papillate without. Corolla white, densely tomentellous without, the tube about 4 mm. long and 1.5 mm. broad, the lobes ovate, about 1.5 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Ovary ovoid, sulcate, glabrous, about 1.5 mm. long.

Lower Amazon valley, in forests on *terra firma*; flowering from August to October.

Vernacular name: *Carapanaúba* (Capucho).

BRAZIL: PARÁ: Lago Salgado, Rio Trombetas infer., *Ducke* 22456 (K, U, US); Boa Vista, Tapajos region, *Capucho* 457 (F).

31. *ASPIDOSPERMA NITIDUM* Benth. ex Muell. Arg. in Mart. Fl. Pras. 6<sup>1</sup>:59. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Spruce* 1651!).

*Thyroma nitida* (Benth.) Miers, Apoc. So. Am. 24. 1878.

*Aspidosperma aquaticum* Ducke, in Archiv. Inst. Biol. Veg. Rio Jan. 4:59, pl. 3, fig. 8. 1938. (T.: *Ducke* 24570!).

Small trees with slender glabrous branches with dark brown, conspicuously lenticellate bark. Leaves broadly elliptic to oval, apex broadly obtuse or rounded, base obtuse, not revolute-auriculate, 5–15 cm. long and 2.5–7.0 cm. broad, rather thinly coriaceous, glabrous and rather lustrous above, beneath glabrous or indefinitely papillate; petioles 1.0–1.5 cm. long. Inflorescence dichotomously cymose, lateral toward the tip of the leafy branches, 1.5–3.0 cm. long, rather few-flowered and indefinitely congested, puberulent-papillate, the bracts inconspicuous, the pedicels about 1 mm. long. Calyx lobes somewhat unequal, ovate, obtuse, 1.0–1.5 mm. long, grayish tomentellous-papillate. Corolla greenish, minutely tomentellous-papillate without, the tube about 3 mm. long, the lobes ovate, about 0.5 mm. long. Anthers inserted within the upper third of the corolla tube, about 0.5 mm. long.



Fig. 9. *Aspidosperma nitidum* Benth.: Flowering branch, dissected flower, and fruit; *Aspidosperma oblongum* A. DC. (lower left): lower face of leaf.

Ovary ovoid, sulcate, glabrous, about 0.5 mm. long. Follicles broadly obovate or oval, about 4 cm. long and 2.5–3.0 cm. broad, prominently verrucose.

Upper Amazon valley, in inundated forests; flowering intermittently.

Vernacular name: *Carapanaúba* (Ducke).

BRAZIL: AMAZONAS: Manáos, *Ducke* 24570 (G, K, MO, NY, U, US), 660 (F, MO, NY, US), 624 (F, MO, NY, US), 309 (F); Barro do Rio Negro, *Spruce* 1651 (GH, NY, P, W).

32. *ASPIDOSPERMA AURICULATUM* Mgf. in Notizbl. 12:299. 1935; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:365. 1947. (T.: *Ducke* 22450!).

Large trees; branches relatively slender, inconspicuously puberulent-papillate when young, soon glabrate and with dark brown, inconspicuously lenticellate bark.

Leaves broadly oval, apex broadly rounded, base broadly obtuse and rather inconspicuously revolute-auriculate, 8–12 cm. long and 4.0–6.5 cm. broad, moderately coriaceous, glabrous and opaque above, paler and very minutely papillate beneath; petioles 1.0–1.5 cm. long. Inflorescences lateral toward the tip of the leaf branches, about 4–6 cm. long, relatively lax, the peduncle inconspicuously puberulent-papillate and several times dichotomous, the bracts inconspicuous, the pedicels about 1 mm. long. Calyx lobes nearly equal, ovate, acute, about 2 mm. long, pale yellowish tomentellous-papillate without. Corolla minutely yellowish tomentellous-papillate without, greenish white, the tube about 3 mm. long, the lobes ovate, about 1 mm. long. Anthers inserted within the upper third of the corolla tube, about 1 mm. long. Ovary ovoid, sulcate, glabrous, about 0.5 mm. long. Fruits unknown.

Lower Amazon valley in forests on *terra firma*; flowering in January.

Vernacular name: *Carapanaiiba* (Ducke).

BRAZIL: PARÁ: Belém, inter locos Catu et Providencia, Ducke 22450 (MO, P, U, US).

33. *ASPIDOSPERMA Pichonianum* Woodson, spec. nov.

Arbores ca. 15–30 m. altae; ramulis graciliusculis juventate minute denseque luteo-papillatis maturitate fuscis et vix lenticellatis. Folia anguste elliptica vel elliptico-lanceolata apice gradatim acuteque acuminata basi anguste cuneata ibique margine revoluta 5–11 cm. longa 1.5–4.0 cm. lata moderate coriacea supra glabra illustria subtus pallidiora et minute griseo-papillata; petiolis ca. 1 cm. longis. Inflorescentiae cincinnate laterales cymosae multiflorae 2–3 cm. longae hemisphaericae dense cinereo-puberulae; pedunculis repetite ramosis; bracteis vix manifestis; pedicellis ca. 1 mm. longis. Calycis laciniae plus minusve inaequales ovatae late obtusae 1.5–2.0 mm. longae extus dense griseo-luteae tomentello-papillatae. Corolla virescens extus luteo-tomentella; tubo ca. 3 mm. longo; lobis late ovatis ca. 1 mm. longis. Antherae ca. 1 mm. longae. Ovarium ovoideum ca. 1 mm. longum dense tomentello-papillatum. Fructus ignoti.

Eastern Venezuela, in forested slopes; flowering in November.

Vernacular names: *Poretay-yek*, *Cabo de bacha* (Steiermark).

VENEZUELA: BOLIVAR: wooded slopes of Quebrada O-paru-má between Sta. Teresita de Kavanayén and Río Pacairo (tributary of Río Mouak), alt. 1065–1220 m., November 20–21, 1944, J. A. Steiermark 60378 (F, MO, HOLOTYPE).

A very unusual plant particularly because of the numerous, cincinnately arranged inflorescences. Dr. Steiermark reports that the sap in the leaves and stems is milky, and that the wood is very strong, being used for ax-handles and other implements. The species commemorates my friend M. Marcel Pichon, of the Muséum National d'Histoire Naturelle.

SERIES VII. *STEGOMERIA* Woodson, n. ser.

Trees with milky latex, apparently evergreen, with moderately thin rimose bark, conspicuously lenticellate. Branches with naked acuminate buds, the subtending internode scarcely thicker than the terminal petiole and the bud thus appearing pseudo-lateral, without definite seasonal articulations. Inflorescence sub-

terminal and usually extra-axillary, pedunculate or cauliflorous, without evident bracts; calyx lobes 4, abnormally 5, the outer pair much larger and strongly connate (except in *A. illustre*), completely enclosing the inner pair which are separate and much smaller; corolla tubular-salverform, submembranaceous, the lobes ascending, the tube not constricted at the orifice, sericeous without; ovary essentially terete. Follicles very broadly dolabriform, plano- to concave-convex, the placenta rotating about  $275^{\circ}$ – $300^{\circ}$ , sessile or shortly stipitate, with a loose, wrinkled, and more or less lenticellate periderm; seeds with a concentric circular wing.

*Species 34–36*

Figure 10.

#### KEY TO THE SPECIES

- a. Corolla 2.6–2.8 cm. long; outer calyx lobes about 1.5 cm. long, free to the base or nearly so; leaves revolute-auriculate at the base..... 34. *A. ILLUSTRE*
12. Corolla about 0.9–1.2 cm. long; outer calyx lobes 2–6 mm. long, connate about half their length; leaves not revolute-auriculate.
  - b. Inflorescence with an obvious, once- to thrice-dichotomous peduncle 1–2 cm. long; follicles indefinitely papillate to essentially glabrous, conspicuously lenticellate..... 35. *A. STEGOMERIS*
  - bb. Inflorescence virtually sessile, the obscure peduncle about 1–3 mm. long; follicles densely velutinous-papillate, not obviously lenticellate.. 36. *A. CURRANII*
34. *ASPIDOSPERMA ILLUSTRE* (Vell.) Kuhlman & Pirajá, in Arch. Jard. Bot. Rio Jan. 4:375, pl. 35. 1925.

*Continia illustris* Vell. Quinogr. Portug. 166, pl. 10. 1799.

Tall trees with sulcate trunks 2–3 dm. in diameter, the branches rather stout, essentially glabrous, conspicuously lenticellate. Leaves oblong-elliptic, apex obtuse to broadly acute, base rounded and revolute-auriculate, 5–12 cm. long and 2–5 cm. broad, subcoriaceous, lustrous above, paler and submicroscopically papillate beneath; petioles 1.5–2.0 cm. long. Inflorescence terminal or subterminal, thyrsiform, few- to several-flowered, somewhat shorter than the subtending leaves, conspicuously bracteate, the pedicels about 1.5 cm. long. Calyx lobes very unequal, essentially free, the outer pair much the larger, broadly oval, rounded, about 1.5 cm. long, the inner much smaller, ovate, acute to acuminate, 2–5 mm. long. Corolla wholly glabrous without, pilosulose within, the tube 1.2–1.3 cm. long, the lobes broadly elliptic, 1.4–1.5 cm. long. Stamens inserted above midway within the corolla tube, the anthers about 3 mm. long. Ovary oblongoid, about 1.5 mm. long, glabrous. Follicles very broadly dolabriform, abruptly narrowed to a short stout stipe, about 10 cm. long and 7 cm. broad, smooth, glabrous; seeds with a nearly circular wing about 7 cm. in diameter.

Eastern Brazil, in forests.

Vernacular names: *Tambú peroba*, *Quina de camamú* (Serviço Florestal; Limeira).

BRAZIL: BAIÁ: Mattas do Gronogogy, *Limeira 17935* (MO), *Curran 41* (GH, US). MINAS GERAIS: Caratinga, *Serviço Florestal 107* (MO).

Before having seen the flowers of this species, generously given me by Dr. Kuhlmann, I had placed this species in the series *NIITIDA* because of the revolute-auricu-

late leaf bases. And that character of *A. illustre*, together with the separate outer calyx lobes, certainly must be very significant in providing a link between series NITIDA and STEGOMERIA. The follicles of *A. illustre*, however, are very typical of STEGOMERIA; furthermore, although there is a strong tendency toward inequality in the calyx lobes of NITIDA (cf. *A. discolor*), it is nowhere as marked as in *A. illustre*.

35. *ASPIDOSPERMA stegomeris* (Woodson) Woodson, comb. nov.

*Cufodontia stegomeris* Woodson, in Archivio Bot. 10:39. 1934; N. Am. Fl. 29<sup>2</sup>:123. 1938. (T.: *Cufodontis* 220!).

*Cufodontia Lundelliana* Woodson, in Archivio Bot. 10:40. 1934; N. Am. Fl. 29<sup>2</sup>:124. 1938. (T.: *Lundell* 3408!).

*Cufodontia arborea* Woodson, in Ann. Missouri Bot. Gard. 21:617. 1934; N. Am. Fl. 29<sup>2</sup>:123. 1938. (T.: *Morton & Makrinius* 2692!).

*Aspidosperma Lundellianum* Woodson, in Am. Jour. Bot. 22:684. 1935; N. Am. Fl. 29<sup>2</sup>:120. 1938. (T.: *Lundell* 1284!).

*Cufodontia escuintlensis* Matuda, in Madroño 10:174. 1950. (T.: *Matuda* 16978!).

Trees as much as 33 m. in height, the branches rather slender, indefinitely puberulent-papillate when very young, soon becoming glabrate and with a thin, striate, conspicuously lenticellate, yellowish-gray bark. Leaves alternate, rather narrowly elliptic-oblong to broadly oval, apex shortly acuminate to broadly rounded, base broadly obtuse to rounded, 6–16 cm. long and 2.5–7.0 cm. broad, firmly membranaceous to subcoriaceous, above dark green, glabrous, and somewhat lustrous, beneath paler and indefinitely papillate to essentially glabrous; petioles 0.7–1.5 cm. long. Inflorescences lateral and extra-axillary near the tips of the leafy branches, cymose, several-flowered, more or less densely yellow-papillate, the peduncle once- to thrice-dichotomous and about 1–2 cm. long; bracts extremely inconspicuous or absent; pedicels 1–5 mm. long. Outer calyx lobes 3–6 mm. long, more or less densely yellow-papillate. Corolla yellowish-white, the tube 4–6 mm. long, about 1.5 mm. broad, densely and appressed velutinous-papillate without, the lobes oblong-elliptic, 5–6 mm. long, essentially glabrous without. Stamens inserted about midway within the corolla tube, the anthers about 1.2 mm. long. Ovary ovoid, glabrous, about 1 mm. long. Follicles broadly subreniform to nearly circular, 7–11 cm. long and 6.5–8.0 cm. broad, sessile, indefinitely papillate to essentially glabrous, covered with small lenticels.

Southern Mexico to Costa Rica, in various types of forest; flowering from February to July.

Vernacular names: *Chichi blanco* (Chiapas—Matuda); *Pechmax*, *Pechmox* (Yucatan—Flores); *Malady blanco*, *Peechmaax* (Lundell—British Honduras); *Chichica* (Standley—Guatemala).

MEXICO: CAMPECHE: Tuxpena, *Lundell* 1284 (F, GH, MO, NY, US). CHIAPAS: *Cacaluta*, *Matuda* 16978 (F); *Esperanza*, *Matuda* 17538 (F).

BRITISH HONDURAS: El Cayo District, *Lundell* 6220 (MO), 6360 (MO).

GUATEMALA: PETEN: La Libertad, *Lundell* 3408 (MO); Carmelita, *Egler* 42-320 (MO); Vaxactun, *Barlett* 12660 (F, MO, NY, S, US). RETALHULEU: vicinity of Retalhuleu, *Standley* 88803 (F, MO).





Fig. 10. *Aspidosperma stegomeris* (Woodson) Woodson: Flowering branch, entire and dissected flower, dissected calyx, and fruit.

COSTA RICA: PUNTARENAS: Jiménez, *Cufodontis* 220 (W).

The embarrassing synonymy of this species is largely due to my failure, on the one hand, to associate the peculiar flowering specimen of *Cufodontia stegomeris* with the fruit of *Aspidosperma Lundellianum*, and to appreciate the variability of the species, upon the other. The circumstances have been discussed by Mr. Matuda (loc. cit. 1950).

Standley reports that in Guatemala the species is a common and important lumber tree; Matuda reports that in Chiapas it has no use as timber, but can be used for firewood. Matuda also says that the bark is used to make a bitter concoction for the treatment of malaria.

36. *ASPIDOSPERMA CURRANII* Standl. in Trop. Woods 36:14. 1933. (T.: Curran 294!).

Trees as much as 30 m. tall, the branches relatively slender, glabrous, with rather thin, striate, yellowish brown, inconspicuously lenticellate bark at maturity. Leaves narrowly oblong-elliptic, apex acutely acuminate, base rather narrowly

attenuate to the petiole, 7-15 cm. long and 2.5-3.5 cm. broad, firmly membranaceous, glabrous; petioles 0.5-1.0 cm. long. Inflorescences lateral and extra-axillary somewhat below the tip of the leafy stems, virtually sessile, the obscure peduncle about 1-3 mm. long, bearing 2-5 sessile, greenish-yellow flowers. Outer calyx lobes about 2 mm. long, densely yellow-papillate. Corollas not seen (color from Castañeda). Follicles very broadly subreniform to nearly circular, about 6 cm. in diameter, densely velutinous-papillate, not obviously lenticellate.

Northern Colombia, in lowland forests; flowering in April.

Vernacular names: *Carreño* (Whitford & Pinzon); *Caretillo* (Castañeda).

COLOMBIA: BOLIVAR: vicinity of Estrella, Curran 294 (GH). CALDAS: Buenavista, Whitford & Pinzon 2 (F, GH, K, NY, US). MAGDALENA: Tucurínca, Castañeda 636 (MO); Pinijay, Castañeda 1105 (MO).

#### SERIES VIII. QUEBRACHINES Woodson, n. ser.

Ser. *Macrolobii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895; § *Pungentia* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:368. 1947.

Trees with thin, yellowish-gray, rimose bark, apparently evergreen. Branches with small scaly buds, but without definite seasonal articulations, the nodes knobby. Leaves opposite or ternate, small and narrow, spine-tipped, coriaceous (firmly membranaceous in *A. borco-kebracho*), the veins more or less immersed but crowded and sharply ascending. Inflorescences chiefly axillary at the upper nodes, thyriform, usually rather few-flowered, with small caducous bracts; corolla tubular-salverform, glabrous or indefinitely papillate, somewhat coriaceous, the lobes narrow and ascending, the tube not constricted at the orifice. Follicles broadly oval to subcylindric, almost equally bi-convex, the placenta rotating about 45°-135°, indistinctly papillate to essentially glabrous, more or less obviously lenticellate, sessile but with the pedicel conspicuously accrescent in *A. quebracho-blanco*—shortly stipitate and the pedicel not accrescent in *A. borco-kebracho*; seeds with a nearly circular concentric wing.

*Species 37-38*

Figure 11.

#### KEY TO THE SPECIES

- a. Leaves coriaceous, with 20-30 pairs of closely crowded secondary veins; inflorescences several- to many-flowered, usually densely canescent; follicles woody, sessile but the fruiting pedicel accrescent to form a false stipe..... 37. *A. QUEBRACHO-BLANCO*
  - aa. Leaves firmly membranaceous to subcoriaceous, with about 10 pairs of more distant secondary veins; inflorescences few-flowered, glabrous; follicles coriaceous, abruptly constricted to a short, narrow stipe, the fruiting pedicel not greatly accrescent..... 38. *A. HORCO-KEBRACHO*
37. *ASPIDOSPERMA QUEBRACHO-BLANCO* Schlecht. in Bot. Zeit. 19:137. 1861; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:368. 1947. (T.: Burmeister s. n.)
- Macaglia Quebracho* O. Ktze. Rev. Gen. 2:416. 1891. (Based upon *A. quebracho-blanco* Schlecht.).
- Macaglia quebracho-blanco* (Schlecht.) Lyons, Pl. Names Sci. & Pop. ed. 2, 286. 1907.

- Aspidosperma quebracho-blanco* Schlecht. ssp. *brevifolium* Hassl. in Fedde, Repert. 12:261. 1913. (T.: Hassler 12003).
- Aspidosperma chakensis* Speg. in Physis 3:333. 1917. (T.: Spegazzini s. n.).
- Aspidosperma crotalorum* Speg. loc. cit. 334. 1917. (T.: Spegazzini s. n., photo. US!).
- Aspidosperma quebracho-blanco* Schlecht. var. *ellipticum* Mgf. in Notizbl. 12:300. 1935. (T.: Rojas 14268).
- Aspidosperma quebracho-blanco* Schlecht. forma *Schlechtendaliana* Mgf. loc. cit. 13:467. 1937. (A. *quebracho-blanco* form. *typ.*).
- Aspidosperma quebracho-blanco* Schlecht. forma *Malmeana* Mgf. loc. cit. 1937. (T.: Malme s. n.).
- Aspidosperma quebracho-blanco* Schlecht. forma *Spegazziniana* Mgf. loc. cit. 1937. (Based on *A. crotalorum* Speg.).

Trees 5–20 m. tall, the branches slender, minutely papillate when young, soon becoming glabrate and with thin, orange-brown bark. Leaves opposite or ternate, narrowly oblong-elliptic to obovate or oblanceolate, apex gradually narrowed to a sharp spine, base gradually attenuate to a subpetiolar base, 3–5 cm. long and 0.5–1.5 cm. broad, coriaceous, light, frequently yellowish-green, glabrous or minutely papillate when young, the sharply ascending secondary veins of about 20–30 pairs closely crowded and more or less immersed within the thick mesophyll. Inflorescences opposite or ternate in the upper leaf axils, thyrsiform, densely cinereous-papillate to nearly glabrous, several- to many-flowered, 1–3 cm. long, the bracts minute, caducous, the pedicels 2–3 mm. long. Calyx lobes ovate, obtuse, nearly equal, 1–2 mm. long, indefinitely papillate. Corolla white, yellow, or yellowish green, glabrous to indefinitely papillate without, the tube 3–5 mm. long, about 1.5 mm. broad, the lobes narrowly oblong-lanceolate, 6–7 mm. long. Stamens inserted about midway within the corolla tube, the anthers about 1 mm. long. Ovary ovoid, glabrous, about 1 mm. long. Follicles very variable, subcylindric to broadly oval, 4–10 cm. long and 1–7 cm. broad, very woody, minutely verrucose, with or without a midrib, indefinitely papillate, sessile, but the fruiting pedicel conspicuously accrescent.

Southeastern Bolivia and roughly the northern half of Argentina and adjacent Paraguay and Uruguay, from 15 to 1800 m. elev., in xerophilous woodlands; flowering intermittently, but chiefly from October to February.

Vernacular names: *Quebracho blanco* (Schlechtendal et al.); *Ubirá-ro-puütá* (Argentina—Spegazzini); *Kacha-kacha* (Bolivia—Cárdenas).

PARAGUAY: zwischen Río Apa und Río Aquidabán, Centurión, *Fiebrig* 4250 (GH, US); Pilcomayo River, *Morong* 900 (F, GH, MO, NY, US); locality lacking, *Balansa* 4644 (C, NY, P, US), *E. Palmer* s. n. (US).

URUGUAY: Sta. Solía, orillas del Río Uruguay, *Rosengurtt* B-3240 (MO, US).

BOLIVIA: COCHABAMBA: Misque, *Cárdenas* 2144 (GH). STA. CRUZ: Mairana, *Steinbach* 8278 (F, GH).

ARGENTINA: CATAMARCA: Capital, *Castillon* 1569 (GH). CHACO: Taco Pozo, *Cabrera* 3168 (NY); Fontana, *Meyer* 19 (NY); Barranqueras, *Curran* 12 (US), 39 (US), 43 (GH, NY, US); locality lacking, *Curran* 653 (F, NY). CORDOBA: Estancia Germania, *Lorentz* s. n. (GH); Cordoba, *Hieronymus* s. n. (F, US); Quilino, *Curran* 129 (US); Serrezuela, *Bartlett* 19236 (US); Las Tapas, *Bartlett* 20640 (GH, US); Capillo del Monte, *Kurtz* 6631 (NY). CORRIENTES: Goya, *Curran* 242 (US), 235 (US); San Cosme, *Parodi*



Fig. 11. *Aspidosperma quebracho-blanco* Schlecht.: Flowering branch, entire and dissected flower, fruit, and seed.

12085 (GH). ENTRE RIOS: Gualaguaychú, *Serie & Migoya* 673 (MO). FORMOSA: Pozo del Tigre, *Parodi* 8504 (GH); Pironi, *Morel* 982 (F); locality illegible, *Jørgensen* 1958 (GH, MO, US). JUJUY: San Pedro de Jujuy, *Eyerdam & Beetle* 22511 (GH). LA RIOJA: Milagro, *Varela* 777 (US); Capital, *Giocomelli* s. n. (MO); Gral. Roca, *Gómez* 771 (MO). MENDOZA: Alto Pencoso, *Jørgensen* 193 (C). SALTA: Sierra Sta. Barbara, *Schnel* 47 (MO); Sierra de la Candelaria, *Venturi* 9791 (GH, MO, NY); Quebrachal, *Castellanos* 1748 (MO). SAN LUIS: Sierra Varela, *Castellanos* 2908 (MO); Quines, *Castellanos* 882 (MO); Larca, *Castellanos* 2634 (MO); Sierras de La Quijadas, *Castellanos* 2238 (MO). STA. FE: Lanteri, *Job* 1180 (NY); Mocovi, *Venturi* 7 (MO); Dpto. Gral Obligado, *Ragonese* 3111 (MO); Dpto. San Justo, *Ragonese* 2734 (MO). SANTIAGO DEL ESTERO: San Sebastian, *Gramajo* 10 (US); El Charco, *Schreiter* s. n. (GH). TUCUMAN: Vipos, *Venturi* 1373 (F, GH, MO, US); Burroyaco, *Venturi* 7479 (F, US); Tapia, *Rodriguez* 195 (MO).

Admittedly, *A. quebracho-blanco* is a variable species, but no more so, probably, than most other species of this genus or many others. Most variable, in this, is the type of fruit, which forms the basis for Markgraf's definition of forms. Without personal experience in the field, I am hesitant to adopt these, for I think it very probable that the fruit types are not actually of three discontinuous sorts but rather form a continuous series which would prove embarrassing to one attempting infra-specific classification. This surely has been the case in the systematics of the North American forest flora.

*A. quebracho-blanco* is a well-known timber tree of Argentina and Paraguay. Spegazzini reports that its bitter bark is used also as a treatment for malaria and other fevers.

38. *ASPIDOSPERMA HORCO-KEBRACHO* Speg. in Speg. & Girola, Descr. Maderas, 380. 1910; in Physis 3:335. 1917. (T.: Spegazzini 1602, photo. US!).

Trees as much as 25 m. tall, the branches relatively slender, glabrous, with rather thin, orange-brown bark at maturity. Leaves opposite or ternate, elliptic to oblanceolate-oblong, apex acute to obtuse with a rather short spine at the tip, base acutely to obtusely cuneate to the subpetiolar base, 2–4 cm. long and 0.5–1.0 cm. broad, glabrous, firmly membranaceous to subcoriaceous, the secondary veins of about 10 pairs, relatively distant and plainly evident upon either surface. Inflorescences opposite or ternate in the upper leaf axils, reduced to an umbelliform cluster of 2–4 flowers, occasionally 1-flowered, glabrous, the peduncles 2–4 mm. long, the bracts minute, apparently persistent, the pedicels 1–2 mm. long. Calyx lobes ovate, acute, about 1 mm. long, glabrous. Corolla reddish (Spegazzini), glabrous without, the tube about 4 mm. long and 1 mm. broad, the lobes narrowly oblong-lanceolate, about 3 mm. long. Anthers somewhat less than 1 mm. long, inserted about midway within the corolla tube. Ovary ovoid, about 1 mm. long, glabrous. Follicles broadly obovate to nearly circular, 3–5 cm. in diameter, coriaceous, glabrous, not obviously lenticellate, with a more or less conspicuous midrib, abruptly constricted to a narrow stipe about 0.5 cm. long.

Northern Argentina, in dry mountain forests; flowering from November to February.

Vernacular names: *Horco-kebracho* (Spegazzini); *Quebracho-blanco* (Curran).

ARGENTINA: CHACO: Barranqueras, Curran 86 (F, GH, NY, US); Fontana, Meyer 7 (NY). STA. FE: Depto. Gral Obligado, Ragonese 3645 (MO).

Spegazzini reports that the timber of this species is as desirable as that of *A. quebracho-blanco*.

#### SERIES IX. NOBILES Woodson, n. ser.

Ser. *Macrolobii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>2</sup>:141. 1895, in part; § *Crassituba* M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947.

Trees with red or milky latex, apparently evergreen, with close hard bark, not obviously lenticellate (except *A. decussatum*). Branches with naked acuminate

buds, the subtending internode definitely thicker than the terminal petiole, without definite seasonal articulations and with the leaves not definitely crowded toward the tips. Leaves alternate (opposite in *A. decussatum*), usually rather rigidly coriaceous, the secondary veins usually sharply ascending or horizontal and not forking toward the margin. Inflorescence variously thyrsiform, the primary branches usually whorled or fastigate, terminal or subterminal, usually many-flowered, with persistent but irregularly disposed bracts; corolla tubular-salverform, glabrous or essentially so, subcoriaceous, the lobes usually lance-linear and abruptly caudate-acuminate from near the base (except in *A. Fendleri*), tightly spiral-convolute in aestivation (except *A. Fendleri*), erect at anthesis, the tube not constricted at the orifice, longitudinally callose-angulate. Follicles somewhat pyriform to nearly circular or subcylindric, almost equally bi-convex, the placenta rotating about  $120^{\circ}$ – $180^{\circ}$ , stipitate to sessile, densely tomentellous, not obviously lenticellate; seeds with a concentric nearly circular wing.

## Species 39–52

Figure 12.

## KEY TO THE SPECIES

- a. Inflorescence of thyrsiform or corymbiform aspect, the determinate branches about as long as the ascending lateral branches, the flowers borne at about a common rounded or flat-topped level.
  - b. Corolla lobes about as long as the tube or somewhat longer.
    - c. Corolla lobes ovate to ovate-lanceolate, acute, scarcely contorted in aestivation; inflorescence black- or dark gray-tomentellous; leaves oblong-obovate, 6–11 cm. long, white-tomentellous beneath; follicles oval to ovoid, sessile or subsessile, black- to dark brown-tomentellous, 7–12 cm. long..... 39. *A. FENDLERI*
    - cc. Corolla lobes lanceolate-linear, abruptly caudate-acuminate from the base, strongly spiral-contorted in aestivation.
      - d. Pedicels about twice as long as the calyx lobes at anthesis; inflorescence white or light gray-tomentellous; leaves elliptic-obovate, 10–20 cm. long, white- or light gray-tomentellous beneath; follicles ellipsoid, broadly stipitate, dark brown-tomentellous, 10–11 cm. long..... 40. *A. SPRUCEANUM*
      - dd. Pedicels about as long as the calyx lobes to somewhat shorter.
        - e. Calyx lobes foliaceous, about 5 mm. long, as long as the corolla tube or slightly longer; inflorescence grayish yellow-tomentellous; leaves oval-obovate, rigidly coriaceous, 8–13 cm. long, yellow-tomentellous beneath..... 41. *A. STEYERMARKII*
        - ee. Calyx lobes subfoliaceous, about 2–3 mm. long, about half as long as the corolla tube or somewhat less.
          - f. Stems with a thick corky periderm below the inflorescence; leaves obovate to broadly oblong, rounded or very broadly obtuse at the tip, 8–30 cm. long, persistently golden-tomentellous beneath; inflorescence brown-tomentellous; follicles elliptic, narrowly stipitate, black-tomentellous..... 42. *A. NOBILE*
          - ff. Stems without a corky periderm.
            - g. Inflorescences umbelliform or corymbiform, aggregated terminally and subterminally.
              - h. Inflorescences many, gray-tomentellous; calyx lobes about half as long as the corolla tube; leaves chartaceous, narrowly oblong to elliptic-oblong, 8–17 cm. long, acute to obtuse, prominently veined on both surfaces, essentially glabrous; follicles nearly circular, 6–9 cm. in diameter, narrowly stipitate, black-tomentellous..... 43. *A. STEINBACHII*



- hh. Inflorescences few, brown-tomentellous; calyx lobes less than half as long as the corolla tube; leaves coriaceous, oblong-elliptic, obtuse to acute, 6–15 cm. long, glabrous, the venation obscure on both surfaces; follicles nearly circular, rather broadly stipitate, 7–8 cm. in diameter, white-tomentellous..... 44. *A. OBSCURINERVIVM*
- gg. Inflorescences solitary and terminal or in the uppermost leaf axils, paniculiform, the branches relatively distant and alternate, white-tomentellous; leaves elliptic-oblong, subcaudate-acuminate, 8–16 cm. long, minutely white-tomentellous beneath, the venation prominent upon both surfaces; follicles oval, 4–7 cm. long, narrowly stipitate, brown-tomentellous..... 45. *A. VERRUCULOSUM*
- bb. Corolla lobes half as long as the corolla tube or less.
- c. Leaves opposite, broadly obovate, 2–5 cm. long, obscurely yellow-puberulent beneath..... 46. *A. DECUSSATUM*
- cc. Leaves alternate or irregularly approximate.
- d. Leaves persistently tomentellous-papillate beneath.
- e. Inflorescence black- or brown-tomentellous; corolla glabrous; leaves narrowly oblong-elliptic, acute to subcaudate-acuminate, 4–13 cm. long, yellow-tomentellous beneath, becoming gray in age; follicles oval, 8–10 cm. long, rather stoutly stipitate, black-tomentellous..... 47. *A. MELANOCALYX*
- ee. Inflorescence yellowish gray-tomentellous; corolla lobes inconspicuously barbate at the tips; leaves broadly ovate-oblong, rounded or broadly obtuse at base and tip, 7–20 cm. long, gray-tomentellous beneath..... 48. *A. ETEANUM*
- dd. Leaves essentially glabrous beneath, or inconspicuously pilosulose when very young.
- e. Inflorescence brown-tomentellous, relatively short-pedunculate; leaves oblong, obtuse to broadly acute, 5–25 cm. long; follicles broadly oval, 8–15 cm. long, rather stoutly stipitate, sordid brown-tomentellous..... 49. *A. MEGALOCARPON*
- ee. Inflorescence pale orange-tomentellous, relatively long-pedunculate; leaves oblong-elliptic, acutely acuminate, 7–15 cm. long..... 50. *A. LEUCOCYOSUM*
- aa. Inflorescence of distinctly cymose aspect, the determinate branches sessile and much shorter than the divaricate, frequently scorpioid lateral branches, the flowers thus borne at diverse levels.
- b. Leaves elliptic-obovate, 7–15 cm. long, typically glabrous beneath and with crowded secondary venation, infrequently minutely white-tomentellous beneath with more distant venation; follicles nearly circular, narrowly stipitate, about 6–9 cm. in diameter, light brown-puberulent..... 51. *A. ALBUM*
- bb. Leaves elliptic to oblong-elliptic, 12–25 cm. long, light brown-tomentellous beneath and with rather distant secondary venation..... 52. *A. SANDWITIIANUM*

39. *ASPIDOSPERMA Fendleri* Woodson, spec. nov.

Arbores usque ca. 25 m. altae; ramulis sat crassiusculis juventate minute albo-puberulis tandem glabratibus cortice atro-fusco vix perspicue lenticellato. Folia alternata vel approximata lamina late obovato-oblonga apice rotundata saepe emarginata basi obtuse cuneata vel rotundata 6–11 cm. longa 3–6 cm. lata coriacea supra nitida venis secundariis vix visis subtus minute denseque albo-velutina venis secundariis subprominulis utroque latere ca. 12–16 subarcuatis; petiolo ca. 1–2 cm. longo. Inflorescentia terminalis thyrsiformis valde plano-corymbiformis multiflora ca. 4–9 cm. longa, bracteis vix bene visis; pedicellis 1–4 mm. longis atro-griseo-tomentellis (pilis albis et nigris interspersis). Calycis lacinae ovato-lanceolatae acutae 3–4 mm. longae atro-griseo-tomentellae. Corolla extus glabra; tubo valde angulato ca. 3–5 mm. longo et 1.5 mm. lato; lobis anguste ovatis vel ovato-

lanceolatis acutis nec caudato-acuminatis nec alabastro valde spiraliter contorto more specierum propinquorum. Antherae in medio tubi corollae insertae ca. 1 mm. longae. Ovarium globosum ca. 1 mm. altum glabrum. Folliculi plus minusve compressi ellipsoidei sessiles vel subsessiles 7–12 cm. longi 5–7 cm. lati plus minusve lignosi atro- vel griseo-tomentelli; seminibus late ovalibus ca. 6 cm. longis 5 cm. latis.

Venezuela and British Guiana, in forests.

Vernacular name: *Koroad-pali* (British Guiana—A. C. Smith).

VENEZUELA: ARAGUA: La Mesa, Parque Nacional, Pittier 15231 (US), Pittier & Nakischenovich 15346 (US), 15397 (US). DISTRITO FEDERAL: Macarao Valley, Delgado 297 (F, MO, US); Caracas, Karsten s. n. (W). MERIDA: Tovar, Fendler 781 (G, GH, K, MO, HOLOTYPE, US), 316 (GH, K).

BRITISH GUIANA: Isherton, basin of Rupununi River, A. C. Smith 2433 (F, G, NY, MO, S, U, US).

This species is quite unique amongst NOBILES because of the broad, loosely contorted corolla lobes. The general relationship of the species appears to be most close to *A. Spruceanum*, which has considerably larger, obovate leaves and longer-pedunculate inflorescences tending to appear in the upper leaf axils, in addition to the common caudate-acuminate, tightly spiral corolla lobes. The likelihood of hybridization of *A. Fendleri* and *A. album* will be discussed briefly under the latter species.

40. *ASPIDOSPERMA SPRUCEANUM* Benth. ex Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:52. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947 (as *A. album*). (T.: *Spruce 2265!*).

*Macaglia Spruceana* (Benth.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma igapoanum* Mgf. in Notizbl. 12:298. 1935. (T.: *Ducke 24568!*).

Rather small trees ("parva" et "vix mediocris", fide Ducke), with rather stout, sulcate branches densely white-tomentellous when young, developing a tight, dark brown bark without obvious lenticels at maturity. Leaves alternate or approximate, broadly obovate to oblong-obovate, rounded at the tip, rounded or broadly cuneate at the base, 10–20 cm. long, 4–11 cm. broad, coriaceous and slightly revolute, above lustrous and glabrous with the secondary and tertiary veins rather apparent, beneath densely white-velutinous with 25–30 subhorizontal secondary veins quite apparent; petioles about 1.5 cm. long. Inflorescences terminal and solitary in the uppermost leaf axils, 12–18 cm. long, corymbosely thyrsiform, the long primary peduncles with several secondary peduncles umbellately fasciculate at the tip, the bracts obvious; pedicels about 4 mm. long, all densely and minutely white-velutinous with few interspersed black hairs. Calyx lobes ovate, acuminate, about 2 mm. long, white- or pale grey-velutinous. Corolla pale yellow or white, glabrous without, the tube about 3 mm. long, the lobes ovate-linear, tightly spiral in the bud, about as long as the tube. Anthers inserted above midway within the corolla tube, about 0.7 mm. long. Ovary glabrous, about 0.5 mm. long. Follicles broadly ellipsoid, 10–11 cm. long and 5–6 cm. broad, woody, densely brown-tomentellous, with a short broad stipe 1.0–1.5 cm. long.

Northern Brazil, in periodically inundated forests; flowering in June.

BRAZIL: AMAZONAS: Santa Izabel, Rio Negro, *Ducke 511* (F, MO, NY, US), 24568 (U, US); San Gabriel do Cachoeiras ad Rio Negro, *Spruce 2265* (C, F, GH, NY, W).

The flat-topped, mostly axillary inflorescences and large obovate leaves of this species help in its identification, since the characteristic pedicels are not fully elongate until anthesis. As a rule, the species of *NITIDA* growing on inundated lands appear to be smaller trees than those growing on *terra firma*.

41. *ASPIDOSPERMA Steyermarkii* Woodson, spec. nov.

Arbores ca. 8–10 m. altae laticem sanguineum exudentes; ramulis crassiusculis juventate minute sulfureo-velutinis mox glabratibus cortice atro-fusco valde compresso. Folia alternata vel approximata late obovata vel elliptico-obovata apice latissime rotundata basi obtuse cuneata ca. 8–13 cm. longa 4.5–8 cm. lata rigide coriacea margine valde revoluta supra illustria venis leviter ascendentibus 25–30 numquam manifestis subtus dense fusco-tomentella venis satius visis; petiolo crasso ca. 2 cm. longo. Inflorescentiae dense corymboso-thyrsoformes multiflorae floribus valde congestis dense fusco-sulfureo-tomentellae ad apicem ramulorum fasciculatim aggregatae ca. 6–10 cm. longae, bracteis vix bene visis; pedicellis ca. 1 mm. longis. Calycis lacinae ovato-lanceolatae acuminatae ca. 5 mm. longae aliquando foliaceae extus fusco-sulfureo-tomentellae (pilis sulfureis et nigris interspersis). Corollae gilvae extus glaberrimae tubo valde calloso-angulato ca. 3.5 mm. longo; lobis ovato-linearibus valde caudato-acuminatis ca. 4 mm. longis in alabastro valde spiraliter contortis. Antherae in medio corollae tubo insertae ca. 1 mm. longae. Folliculi ignoti.

VENEZUELA: BOLIVAR: Ptari-tepuí, steep forested slopes at base of first line of sandstone bluffs, on south-facing part, east of "Cave Rock", alt. 2130 m., November 4, 1944, J. A. Steyermark 59858 (F, MO, HOLOTYPE, NY).

This species is so distinct that its relationships are conjectural wholly. Its habit suggests an affinity with *A. nobile*.

42. *ASPIDOSPERMA NOBILE* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:44. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *St.-Hilaire 760!*).

*Aspidosperma Poblmanum* Muell. Arg. loc. cit. 1860. (T.: *Pobl 1229!*).

*Macaglia nobilis* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Macaglia Poblana* (Muell. Arg.) O. Ktze. loc. cit. 1891.

Trees about 4 m. tall, the branches disproportionally stout, densely golden-tomentellous when young, covered with a thick corky bark at maturity. Leaves closely crowded, broadly oblong to obovate, rounded or broadly obtuse at the tip, broadly cuneate to rounded at the base, 8–30 cm. long and 3–11 cm. broad, heavily coriaceous, densely golden-tomentellous upon both surfaces when young, becoming glabrate and lustrous above at maturity, pale olive-green, the secondary veins about 40 pairs, broadly ascending, rather indistinct upon both surfaces; petioles 1.5–3.0 cm. long, stout. Inflorescences terminal and axillary at the uppermost nodes,

densely golden-tomentellous, 6–12 cm. long, the primary peduncle relatively short with several secondary peduncles corymbosely or umbellately crowded at the tip, the bracts evident; pedicels about 1 mm. long. Calyx lobes ovate-elliptic, acute, about 3 mm. long, golden-velutinous. Corolla yellow, glabrous, the tube callose-angulate, about 4–5 mm. long, the lobes ovate-linear, caudate-acuminate and tightly spiral in the bud, 5–6 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Ovary globose, glabrous. Young follicles rather narrowly ellipsoid, with a conspicuous stipe, densely black- or dark gray-tomentellous, not known at maturity.

Southern Brazil, in sandy and rocky *campos* and *cerrados*; flowering from May to August.

BRAZIL: GOIAZ: entre Bernardo Lobo et Jaragua, *Glaziov* 21742 (C, P); Salinas, *Weddell* 2001 (F, P); locality lacking, *St.-Hilaire* 760 (F, NY, P, US); ad viam a Brejão ad Rio Bonaventura, about 1 mm. long. Ovary globose, glabrous. Young follicles rather narrowly ellipsoid, with a conspicuous stipe, densely black- or dark gray-tomentellous, not known at maturity. MATO GROSSO: Cuyabá, *Malme* s. n. (R, US); locality lacking, *Kuntze* s. n. (NY); *Burckell* 7505 (K).

This utterly distinctive species forms an interesting parallel with *A. verbascifolium*, a geographical relative, because of its thick corky bark.

43. *ASPIDOSPERMA STEINBACHII* Mgf. in Notizbl. 9:1158. 1927. (T.: *Steinbach* 7261!).

Trees as much as 20 m. tall, the branches somewhat thick, essentially glabrous, developing a tight, black bark without evident lenticels at maturity. Leaves broadly ovate-oblong to narrowly oblong-elliptic, apex obtuse or rounded to shortly and obtusely acuminate, base rounded to narrowly cuneate, 8–17 cm. long and 2–7 cm. broad, firmly membranaceous or pergamentaceous, wholly glabrous or indefinitely papillate beneath when very young, lustrous above and somewhat paler beneath, the crowded, almost innumerable secondary and tertiary veins evident upon both surfaces; petioles 2–3 cm. long. Inflorescences crowded subterminally, densely grayish brown-tomentellous, broadly corymbose, 12–15 cm. long, the secondary peduncles umbellated congested, the bracts fairly conspicuous; pedicels about 1 mm. long. Calyx lobes ovate-elliptic, acute, somewhat unequal, about 3 mm. long, densely grayish brown-tomentellous without. Corolla glabrous without, the tube callose-angulate, about 4.0–4.5 mm. long, the lobes ovate-linear, caudate-acuminate, tightly spiral in the bud, about 4 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Ovary about 1 mm. long, glabrous. Follicles broadly elliptic to nearly circular, 7–10 cm. long and 6–9 cm. broad, abruptly narrowed to a slender stipe 4–5 cm. long, densely black-tomentellous; seeds broadly oval or circular, 6–9 cm. in diameter.

Eastern Peru and Bolivia, in forests; flowering from July to November.

Vernacular names: *Pinchi-caspi* (Peru—Ll. Williams; *Gavetillo* (Bolivia—Steinbach)).

PERU: SAN MARTIN: Tarapoto, *Ll. Williams 5816* (F, MO, US).

BOLIVIA: STA. CRUZ: Buenavista, Prov. Sara, *Steinbach 7261* (F, GH, MO, NY, U),  
7356 (F, GH, MO, NY, U). LA PAZ: San Bartolomé, near Calisaya, Prov. S. Yungas,  
*Krukoff 10290* (F, MO, U, US).

Although not conveyed by the key, I believe that *A. Steinbachii* is closely related to *A. melanocalyx* of eastern Brazil, largely because of the similar shape and indument of the fruits, although the leaves and indument of the inflorescence may ally it more directly to *A. megalocarpon* of Colombia and Central America.

44. *ASPIDOSPERMA OBSCURINERVIUM* Azambuja, in *Rodriguesia* 9:51, *pl. I.* 1947. (T.: *Ducke 931!*).

Tall trees with relatively slender branches inconspicuously gray-pilose when young, soon becoming glabrate and with a tight, blackish brown bark. Leaves broadly oblong-elliptic, obtuse to broadly acute at the tip, the base broadly obtuse, 6–15 cm. long, 2.5–5.0 cm. broad, coriaceous, the venation obscure on both surfaces, glabrous and lustrous above, paler and submicroscopically papillate beneath; petioles 1–2 cm. long. Inflorescence terminal and few in the uppermost leaf axils, corymbose-thyrsoform, about 2–8 cm. long, the secondary peduncles more or less umbellately fasciculate at the tip of the primary peduncle, brown-tomentellous, the bracts inconspicuous; pedicels about 1 mm. long. Calyx lobes rather unequal, ovate, acute, somewhat less than 2 mm. long, gray-tomentellous without. Corolla yellow, glabrous without, the tube callose-angulate, about 3 mm. long, the lobes ovate-linear, caudate-acuminate, tightly spiral in the bud, about 3 mm. long. Anthers inserted about midway within the corolla tube, about 0.7 mm. long. Follicles nearly circular, 7–8 cm. in diameter, woody, densely white-tomentellous, with a rather broad stipe about 1–2 cm. long; seeds circular, about 7 cm. in diameter.

Upper Amazon valley, in highland forests; flowering in May.

BRAZIL: AMAZONAS: Manáos, ultra Flores, *Ducke 931* (F, MO, NY, US), 1156 (MO, NY, US).

Outstanding, particularly by reason of the white-tomentellous fruits.

45. *ASPIDOSPERMA VERRUCULOSUM* Muell. Arg. in *Mart. Fl. Bras.* 6<sup>1</sup>:51. 1860. (T.: *Spruce 3328!*).

*Macaglia verruculosa* (Muell. Arg.) O. Ktze. *Rev. Gen.* 2:416. 1891.

*Aspidosperma paniculatum* Azambuja, in *Rodriguesia* 10:117, *pl. I.* 1948. (T.: *Ducke 1168!*).

Rather small trees (fide *Ducke*), the branches rather slender, inconspicuously white-papillate when young, glabrate and developing a tight blackish brown bark at maturity. Leaves alternate, rather distant, narrowly elliptic-oblong to oblong-obovate, apex abruptly and shortly obtuse-acuminate, base obtuse to acutely cuneate, 8–16 cm. long and 2.5–6.0 cm. broad, subcoriaceous, the secondary veins almost innumerable, subhorizontal, crowded and apparent on both surfaces, above glabrous, olive-green and lustrous, beneath paler and microscopically white-



papillate; petioles 1.0–2.5 cm. long. Inflorescence solitary and frequently axillary at the upper nodes, paniculiform, the branches alternate and relatively distant, 5–17 cm. long, the branches progressively shorter to the sessile flowers, densely white-papillate, the bracts obscure; pedicels about 1 mm. long or somewhat less. Calyx lobes rather strongly unequal, ovate, acute, about 1 mm. long, densely and minutely white-tomentellous. Corolla white, glabrous without, the tube callose-angulate, about 3 mm. long, the lobes ovate-linear, caudate-acuminate and tightly spiral in the bud, 2.5–3.0 mm. long. Anthers inserted at about midway within the corolla tube, about 0.7 mm. long. Ovary glabrous, about 0.5 mm. long. Follicles elliptic or oval, 4–7 mm. long and 4–5 mm. broad, narrowed to a stipe 0.7–1.5 cm. long, finely brown-tomentellous.

Northern Brazil, in sandy savannas; flowering from March to June.

BRAZIL: AMAZONAS: Manáos, Rio Tarumá-miry, *Ducke* 918 (F, MO, NY, US), 1168 (MO, NY, US), 1419 (US); ad fl. Casiquari, Vasiva et Pacimoni, *Spruce* 3328 (G, GH, NY, P, W); between headwaters of Ira-Igarapé and Igarapé-Abiú, affluent of Rio Tarairá, *Schubert & López* 10190 (US).

Azambuja's name for this species is so appropriate that it is rather a pity to have to discard it in favor of Mueller's. However, it appears quite unavoidable, since the foliage of Spruce's specimen corresponds so closely to that of Ducke's specimens. Spruce's fruits are somewhat smaller and have somewhat more slender stipes than those of Ducke, but I believe that this is due to their relative immaturity.

46. *ASPIDOSPERMA decussatum* Woodson, spec. nov.

Arbusculae vel frutices ca. 3 m. alti laticem lacteum exudentes; ramulis sat crassiusculis juventate minutissime gilvo-pilosulis numquam ancipitis maturitate glabris et cortice fusco-brunneo paulo lenticellato acutis. Folia opposita decussata brevissime petiolata lamina late obovata apice rotundata basi obtuse cuneata 2–5 cm. longa 1.5–3.0 cm. lata rigide coriacea venis secundariis numerosis recte ascendentibus congestis utrimque prominentibus supra olivacea nitida subtus subconcolore et obscure minuteque luteo-pilosula; petiolo ca. 0.5 cm. longo. Inflorescentia terminalis corymboso-thyrsoformis pauciflora breviter pedunculata ca. 2–4 cm. longa omnino fulvide gilvo-tomentella, bracteis vix bene visis; pedicellis ca. 1 mm. longis. Calycis lacinae subaequales ovali-ovatae acutae ca. 3.0–3.5 mm. longae dense gilvo-tomentellae. Corolla alba extus glabra odora, tubo callosangulato ca. 3.5–4.0 mm. longo, lobis ovato-linearibus in alabastro valde spiraliter contortis ca. 2.0–2.5 mm. longis. Antherae in medio tubi corollae insertae ca. 0.7 mm. longae. Ovarium late ovoideum ca. 1 mm. altum glabrum. Folliculi ignoti.

VENEZUELA: BOLIVAR: Ptari-tepuí, on forested south-facing slopes overlying sandstone, on "Cave Rock" above "Cave Camp", alt. 1810 m., October 29, 1944, *J. A. Steyermark* 59506 (F, MO, HOLOTYPE, NY).

Distinct, except for the QUEBRACHINES with which it is not likely to be confused, because of the decussate leaves of most unusual form for the genus.



47. *ASPIDOSPERMA MELANOCALYX* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:52. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *St.-Hilaire s. n.*!).

*Aspidosperma leucomelanum* Muell. Arg. in Kjoeb. Vidensk. Meddel. 105. 1869; M. Pichon, loc. cit. 1947. (T.: *Warming s. n.*!).

*Macaglia melanocalyx* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

Large or small trees (8 m. tall, fide Ducke), the branches relatively slender, compressed-angulate, densely golden-papillate when young, glabrate and developing a tight gray-black bark without evident lenticels at maturity. Leaves narrowly oblong-elliptic, acute to subcaudate-acuminate, the base acutely cuneate to rounded, 4-13 cm. long and 1-5 cm. broad, subcoriaceous, the numerous broadly ascending secondary veins obvious upon both faces, olive-green and lustrous above, densely golden-tomentellous beneath when young, becoming gray-papillate in age; petioles 1.0-2.5 cm. long. Inflorescences terminal and axillary at the uppermost nodes, very densely corymbose-thyriform, very many-flowered, shortly pedunculate, 3-6 cm. long, black- or dark brown-tomentellous throughout, the bracts inconspicuous; pedicels about 1 mm. long or less. Calyx lobes 2-3 mm. long, ovate, blackish brown-tomentellous. Corolla yellow, glabrous without, the tube about 4.5 mm. long, callose-angulate, the lobes ovate-linear, caudate-acuminate, tightly spiral-contorted in the bud, 2.0-2.5 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Ovary about 0.5 mm. long, glabrous. Follicles oval, 8-10 cm. long and 6-7 cm. broad, woody, densely black-tomentellous, abruptly constricted to a stipe 2.0-2.5 cm. long.

Eastern Brazil, in forests; flowering from February to April.

BRAZIL: DISTRITO FEDERAL: Rio de Janeiro, *Glaziou 20414* (C, F, MO, NY, P, US); ad urbem loco Sumaré, *Kublmann 19397* (P, U, US). MINAS GERAIS: Lagoa Santa, *Warming s. n.* (C, NY); Estação Experimental, *Mello Barreto 8794* (F, MO), *8795* (F, MO); locality lacking, *St.-Hilaire s. n.* (P).

Well characterized by the very dense, shortly pedunculate, black-tomentellous inflorescences and small, narrow leaves. The leaves of the type of *A. leucomelanum* are somewhat larger and the inflorescence indument somewhat lighter in color than those of the type of *A. melanocalyx*, but I can observe no more important differences.

Mello Barreto's flowering specimen deserves special mention: the inflorescence is rather loose and the corolla lobes somewhat longer than is typical of the other specimens cited. After dissection of several flowers, I have found the number of stamens to vary from 3 to the normal 5 and their position within the same corolla to vary, as well as their size. There is indeed a slight tendency for the anthers to vary in size within single flowers of both the NOBILES and the NITIDA, but it is so marked in the case of this specimen that I must interpret it as an abnormality.

48. *ASPIDOSPERMA ETEANUM* Mgf. in Notizbl. 12:297. 1935; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *Ducke 22445!*).

Trees as much as 20 m. tall, the branches rather stout, densely yellowish gray-tomentellous when young, glabrate and developing a rather rimose brown bark without evident lenticels at maturity. Leaves alternate or approximate, broadly ovate-oblong, broadly rounded at the tip and at the base, 6–20 cm. long and 3–8 cm. broad, rigidly coriaceous, the numerous and dense secondary veins rather obscure, olive-green and highly lustrous above, pale gray-papillate beneath; petioles 1–2 cm. long. Inflorescences densely crowded terminally and subterminally, very broadly corymbose-thyriform, very many-flowered, shortly pedunculate, 9–15 cm. long and about as broad, densely pale yellowish gray-tomentellous, the bracts inconspicuous, the pedicels about 1 mm. long. Calyx lobes ovate-reniform, rounded, about 2 mm. long, pale yellowish gray-tomentellous. Corolla yellowish, the tube glabrous, callose-angulate, 4–5 mm. long, the lobes ovate-linear, caudate-acuminate and tightly spiral in the bud, inconspicuously barbate, about 2 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Follicles unknown.

Northeastern Brazil, on *terra firma* and hillside forests; flowering from August to October.

Vernacular name: *Muirapyranga* (Capucho).

BRAZIL: AMAZONAS: Parintins, *Ducke 138* (F). PARÁ: Oriximiná, Rio Trombetas infer., *Ducke 22443* (US); Serra de Almeirim, *Ducke 22445* (P, U, US); Boa Vista, region de Tapajos, *Capucho 432* (F).

49. *ASPIDOSPERMA MEGALOCARPON* Muell. Arg. in Linnaea 30:400. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *Karwinsky 1348*).

*Macaglia megalocarpa* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Aspidosperma cruentum* Woods. in Amer. Jour. Bot. 22:684. 1935 (as *cruenta*). (T.: *Bartlett 12570!*).

*Aspidosperma sanguineum* H. H. Bartlett, in Publ. Carnegie Inst. Wash. 461:16. 1935, *nom. nud.*

*Aspidosperma sanguinale* H. H. Bartlett, loc. cit. 22. 1935, *nom. nud.*

*Aspidosperma Matudai* Lundell, in Phytologia 1:339. 1939. (T.: *Matuda 2030!*).

*Aspidosperma chiapense* Matuda, in Madroño 10:172. 1950. (T.: *Matuda 16361!*).

*Aspidosperma chiapense* Matuda forma *tenax* Matuda, loc. cit. 173. 1950. (T.: *Matuda 17386*).

Trees 7–30 m. tall, the trunk 2–8 dm. in diameter and with whitish, rough bark; branches minutely gray-pilosulose when young, soon glabrate and developing a blackish bark without apparent lenticels. Leaves alternate, elliptic-obovate to narrowly oblong, apex acute to broadly obtuse, base acutely or obtusely cuneate, 5–25 cm. long, 2–9 cm. broad, firmly membranaceous to subcoriaceous, wholly glabrous, highly lustrous above, somewhat paler beneath, the secondary veins broadly ascending to subhorizontal, very numerous and crowded; petioles 1–3 cm. long. Inflorescences terminal and axillary at the uppermost nodes, broadly corymbose-thyriform, shortly pedunculate, many-flowered, sordid brown-tomentellous,

the bracts suppressed; pedicels about 1 mm. long or shorter. Calyx lobes somewhat unequal, ovate, acute to obtusish, about 2 mm. long, densely sordid brown-tomentellous without. Corolla yellowish white, glabrous without, the tube callose-angulate, 3–4 mm. long, the lobes ovate-linear, caudate-acuminate, strongly spiral in the bud, about 1.5–2.0 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Ovary globose, glabrous, about 0.7 mm. long. Follicles broadly oval to nearly circular, 8–15 cm. long and 6–11 cm. broad, woody, brown-tomentellous, with a rather broad stipe 1–3 cm. long.

Southeastern Mexico to Colombia and British Guiana, chiefly in dense, rather dry forest, but in forested river bottoms as well; flowering from February to August.

Vernacular names: *Chichi*, *Chichi colorado*, *Chichi prieto*, *Chichi amarillo* (Mexico—Matuda); *Colorado* (Mexico—Ll. Williams); *Volador* (Mexico—Karwinsky); *My lady* (British Honduras—Lundell, Burns, and Record); *Red* and *White malady* (British Honduras—Gentle); *Chichique* (Guatemala—J. D. Smith); *Chaperno* (Honduras—Standley); *Caney*, *Mamey* (Colombia—Castañeda); *Shibadan* (British Guiana—Forest Dept.).

MEXICO: CHIAPAS: Escuintla, *Matuda* 2030 (F, GH, NY, US), 16361 (US). OAXACA: Übero, *Ll. Williams* 9504 (F, MO). VERACRUZ: Fortuño, Coatzacoalcos River, *Ll. Williams* 8729 (F, MO).

BRITISH HONDURAS: Stann Creek, *Gentle* 2800 (MO, NY, US), 2801 (F), 2855 (F, K, MO, NY), 3271 (F, MO); El Cayo, *Lundell* 6326 (GH, MO, NY).

GUATEMALA: ALTA VERAPAZ: Cubilgüitz, *Steyermark* 44520 (F, MO); between Trece Aguas and Cacao, *Cook & Doyle* 47 (US). ESCUINTLA: Escuintla, *J. D. Smith* 2475 (F, GH, US). PETEN: Vaxactun, *Bartlett* 12570 (MO, NY, US), 12663 (MO, US); La Libertad, *Lundell* 3398 (F); locality lacking, *Walker* 1076 (F, GH, US). QUEZALTENANGO: Río Ocosito, *J. D. Smith* 2477 (US). RETALHULEU: Río Samalá, *Shannon* 209 (F, US); Mazatenango, *Bernoulli & Cario* 1836 (K, S). SUCHITEPEQUEZ: Río Sis, *J. D. Smith* 2476 (K); Tiquisate, *Steyermark* 47690 (F).

HONDURAS: ATLANTIDA: Lancetilla Valley, *Standley* 53992 (F, US).

COSTA RICA: LIMON: Pozo Azul, *Lankester s. n.* (US).

PANAMA: CANAL ZONE: Barro Colorado Island, *Kenoyer* 681 (US).

COLOMBIA: MAGDALENA: Caracolicito, region de Sta. Marta, *Castaneda* 96 (COL); entre Tucurínca y Fundación, *Castañeda & Gonzalez* R 365 (COL, MO); Tucurínca, *Castañeda* 620 (MO); Petén, *Dugand* 821 (F).

VENEZUELA: AMAZONAS: San Carlos de Río Negro, *Ll. Williams* 14519a (F, US).

BRITISH GUIANA: sandhills, Demerara River, *Fanshawe* F1226 (K, MO, NY).

This species is obviously one of the most widespread as well as most frequently collected of the genus. Although segregates have been proposed, they are based upon minor variants which appear more or less throughout the entire range and are of little biological significance. Llewellyn Williams reports that the sapwood of the timber is almost white to light brown, and that the heartwood is vermilion or deep reddish brown and constitutes about two-thirds of the bole. He also reports that although the wood frequently is attacked by white ants, it is tough and difficult to split and is used frequently for house construction, beams, and railroad ties in Mexico. Matuda states that the timber is esteemed by lumbermen of Chiapas, and "is so hard when cured that it is impossible to drive a nail into it." (Madroño 10:173. 1950).

50. *ASPIDOSPERMA LEUCOCYMOsum* Kuhl. in Archiv. Inst. Biol. Veg. Rio Jan. 2:88, pl. 6. 1935; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *Ducke 24472!*).

*Aspidosperma leucostachys* Kuhl. ex Mgf. in Notizbl. 12:558. 1935. (T.: *Ducke 24472!*).

Moderate-sized tree (fide *Ducke*) with rather slender branches inconspicuously white-papillate when young but soon developing a dark brown bark without evident lenticels. Leaves alternate or approximate, oblong-elliptic, acutely acuminate, the base obtusely cuneate, 7–15 cm. long and 2.5–5.0 cm. broad, subcoriaceous, the veins rather inconspicuous upon both surfaces, rather pale olive-green and wholly glabrous, lustrous above; petioles 1.5–2.5 cm. long. Inflorescences corymbose-thyriform, 4–9 cm. long, rather few-flowered individually but rather densely clustered terminally and at the congested upper nodes, pale orange-tomentellous, the bracts rather inconspicuous; pedicels about 2 mm. long. Calyx lobes ovate, broadly obtuse to rounded, about 2 mm. long, densely white-tomentellous without. Corolla creamy white, glabrous without, the tube callose-angulate, about 5 mm. long, the lobes ovate-linear, caudate-acuminate and tightly spiral-contorted in the bud, about 2.5–3.0 mm. long. Anthers inserted about midway within the corolla tube, about 1 mm. long. Follicles unknown.

Northern Brazil; flowering in December.

BRAZIL: AMAZONAS: ad ripas altas flum. Curicuriary (affl. Rio Negro super.), *Ducke 24472* (K, MO, P, U, US).

51. *ASPIDOSPERMA ALBUM* (Vahl) R. Ben. ex M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947 (as to basynym).

*Macaglia alba* Vahl, Skrivt. Nat. Selsk. Kjoebenh. 6:107. 1810. (T.: in Hb. Vahl., comm. Richard!).

*Bignonia latisiliqua* Poir. Encycl. Suppl. 1:632. 1810. (T.: *Patris s. n.!*).

*Aspidosperma latisiliquum* (Poir.) A.DC. in DC. Prodr. 8:676. 1844 (as *latisiliqua*).

*Peltospermum latisiliquum* (Poir.) DC. ex A.DC. loc. cit. 1844, *nom. nud. in synon.*

*Peltospermum Patrisii* DC. ex A.DC. loc. cit. 1844, *nom. nud. in synon.*

*Aspidosperma pachypterum* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:51. 1860. (T.: *Spruce 3345!*).

*Aspidosperma desmanthum* Benth. ex Muell. Arg. loc. cit. 52. 1860; M. Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:367. 1947. (T.: *Spruce 2618!*).

*Macaglia pachyptera* (Muell. Arg.) O. Ktze. Rev. Gen. 2:416. 1891.

*Macaglia desmantha* (Benth.) O. Ktze. loc. cit. 1891.

*Aspidosperma Woodsonianum* Mgf. in Notizbl. 12:559. 1935. (T.: *Boschwezen 2330!*).

*Aspidosperma centrale* Mgf. loc. cit. 560. 1935. (T.: *Ducke 21593!*).

Trees 10–30 m. tall, with trunks 3–6 dm. in diameter; branches slender to rather stout, indistinctly papillate when young, soon developing a light brown or blackish bark without evident lenticels. Leaves alternate or approximate, obovate to oblong-elliptic, rounded to shortly acute at the tip, the base obtusely cuneate, 7–15 cm. long and 3–7 cm. broad, coriaceous or subcoriaceous, the secondary typically rather numerous and crowded, typically evident on both surfaces together with the reticulate tertiary venation, occasionally more or less immersed, glabrous



Fig. 12. *Aspidosperma album* (Vahl) R. Ben.: Flowering branch, entire opening bud, dissected fully opened flower, fruit, and seed; *Aspidosperma Spruceanum* Benth.: Inflorescence.

on both surfaces typically, or more or less pruinose beneath, rather lustrous; petioles 2-3 cm. long. Inflorescences typically somewhat congested terminally and in the uppermost leaf axils, 3-12 cm. long, rather long-pedunculate, more or less white- or yellowish-tomentellous, of distinctly cymose aspect, the determinate branches subsessile and much shorter than the divaricate, frequently scorpioid lateral branches, the flowers nearly sessile. Calyx lobes more or less unequal, ovate, 1.5-2.0 mm. long, white- or yellowish-tomentellous. Corolla yellowish green, glabrous without, the tube callose-angulate, 2-3 mm. long, the lobes ovate-linear, caudate-acuminate, tightly spiral in the bud, about 3.5 mm. long. Anthers inserted about midway within the corolla tube, 0.5-0.7 mm. long. Ovary about 0.5 mm. high,



glabrous. Follicles nearly circular, less woody than in other species, 6–9 cm. long and 5–8 cm. broad, rather thinly yellowish brown-puberulent, contracted to a rather slender stipe 1–4 cm. long.

Northeastern Colombia to the Amazon valley, in highland forest (Mora and Wallaba forest in British Guiana); flowering from April to November.

Vernacular names: *Tun-yek* (Venezuela—Steyermark); *Guabadaro* (Venezuela—Ll. Williams); *Siba-danni* and *Shibadan* (British Guiana—Forest Department); *Siferoe adda*, *Mantjotjo*, and *Bitterbark* (Surinam—Boschwezen); *Piquia-marfin*, *Páo amarello*, and *Araraúba* (Brazil—Ducke); *Araracanga* (Brazil—Huber); *Ararabuba* (Brazil—Capucho).

COLOMBIA: MAGDALENA: Salotal, *Castañeda 1131* (MO).

VENEZUELA: AMAZONAS: San Carlos, Rio Negro, *Ll. Williams 14510* (F, MO, US). BOLIVAR: Ptari-tepuí, *Steyermark 60644* (F, MO).

BRITISH GUIANA: Christianburg, *Anderson 125* (K); Essequibo, Tapakuma Lake, *Anderson 337* (K); Simuni Creek, Rupununi River, *Davis 2109* (K); Mazaruni Station, *Fanshawe 5275* (K, U).

SURINAM: Brownsberg, *Boschwezen 1704* (U), *1708* (U); Sectie O, *Stabel 121* (U), *Boschwezen 163* (U), *2330* (U, US), *2726* (U); Zanderij I, *Stabel 77* (U), *Boschwezen 2251* (U), *2389* (U), *2525* (K, U), *2636* (NY, U), *2674* (NY, US).

FRENCH GUIANA: Cayenne, *Patris s. n.* (G); locality lacking, *Richard s. n.* (C), *Martin s. n.* (MO).

BRAZIL: AMAZONAS: prope Panuré, ad Rio Vaupés, *Spruce 2618* (C, GH, NY, P); ad fl. Casiquiari, Vasiva, et Pacimoni, *Spruce 3345* (C, G, GH, P); Manáos, *Ducke 7a* (F), *536* (F, MO, NY, US); Serra de Parintins, *Ducke 21593* (U, US); Manáos, *Ducke 24576* (U, US); São Paulo de Olivença, *Ducke 22415* (MO). PARÁ: Mosqueiro, *Ducke 786* (F, MO, NY, US); Belém, *Huber 3848* (P, US); Collares, *Ducke 12632* (US); Bóia Vista, *Tapajos, Capucho 573* (F).

*Aspidosperma album* is a very variable species. In the lower Amazon valley the leaves are more thin in texture and are nearly glabrous beneath, with prominently reticulate tertiary and secondary venation upon both surfaces, and these characters also are shown by the one specimen to the extreme north of its range in Colombia, and by most specimens from British Guiana. On the other hand, most specimens from the central part of the specific range, in the upper Amazon and in the Guianas and Venezuela, show more coriaceous leaves with less prominent venation and with more or less of a white-tomentellous or pruinose indument on the lower surface; the peduncles also appear to be somewhat stouter, more yellowish in color, and less strongly cymose.

I suspect that this variability may be due to hybridization with either *A. Spruceanum* or *A. Fendleri*; I am rather inclined to interpret the immature but sessile follicles of the type specimen of *A. pachypterum* (*Spruce 3345*) as suggesting the latter species.

Whatever may be responsible for the variability, I am not prepared to attempt resolving it by the labored recognition of several intergrading entities. Unfortunately, the type specimens of all the published species names enumerated at the head of this discussion are of "intermediate" aspect, while the more "pure" populations of Pará and Magdalena are without a segregate name.



The combination *A. album* (Vahl) R. Ben. ex M. Pichon was made to supersede *M. Spruceanum*: however, examination of the type specimen of *Macaglia alba* in Vahl's herbarium at Copenhagen discloses the divaricate inflorescences which support Malme's observation "Secundum specimen in Mus. Haun. asservatum *Macaglia alba* Vahl est *Aspidospermatis* species, *A. desmantho* Benth. peraffinis." (in Arkiv Bot. 21A, no. 6:7. 1927).

52. *ASPIDOSPERMA SANDWITTHIANUM* Mgf. in Notizbl. 12:561. 1935. (T.: *Forest Dept. 2108!*).

Trees as much as 30 m. tall, the branches relatively slender, densely yellowish brown-tomentellous when young. Leaves evidently alternate or approximate, elliptic to oblong-elliptic, apex rather broadly acute to obtuse, base obtusely cuneate, 12-25 cm. long and 4.5-7.5 cm. broad, coriaceous, the approximately 20 pairs of secondary veins impressed within the essentially glabrous, lustrous upper-surface and prominently elevated upon the light brown-tomentellous lower surface; petioles 2.5-4.0 cm. long. Inflorescence clustered terminally and subterminally, rather long-pedunculate, 4-14 cm. long, densely yellowish brown-tomentellous, of distinctly cymose aspect, the determinate branches subsessile and much shorter than the divaricate, more or less scorpioid lateral branches, the flowers nearly sessile. Calyx lobes rather unequal, oblong-ovate, obtusish, about 2 mm. long, densely yellowish white-tomentellous without. Corolla pale yellowish green, glabrous without, the tube callose-angulate, about 3 mm. long, the lobes ovate-linear, caudate-acuminate and tightly spiral in the bud, about 7 mm. long. Stamens inserted above midway within the corolla tube, the anthers about 0.5 mm. long. Ovary globose, about 0.5 mm. long, glabrous. Follicles unknown.

British Guiana, in high "miscellaneous forest"; flowering in August.

BRITISH GUIANA: Simuni Creek, Rupununi River, *Forest Dept. 2108* (K).

Perhaps too closely allied to *A. album*, but with strikingly different leaves and indument, and with unusually long corolla lobes.

EXCLUDED SPECIES

*Aspidosperma anomalum* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:61. 1860 = *MICROPLUMERIA ANOMALA* (Muell. Arg.) Mgf. in Notizbl. 13:458. 1937.

*Aspidosperma clerceanum* Iljin & Kraschen, in Index Kew. Suppl. 7:21. 1929, *sp. balm.* = *ASTRAGALUS CLERCEANUS* Iljin & Kraschen, in Acta Hort. Bot. Acad. Sci. (ante Petrop.) 43:591. 1931.

*Aspidosperma condylocarpon* Muell. Arg. in Mart. Fl. Bras. 6<sup>1</sup>:55. 1860 = *DIPLORHYNCHUS CONDYLOCARPON* (Muell. Arg.) M. Pichon, in Bull. Mus. Nat. Hist. II, 19:368. 1947.

*Aspidosperma macrophyllum* Muell. Arg. in Linnaea 30:397. 1860 = *PARALYXIA MACROPHYLLA* (Muell. Arg.) Mgf. in Notizbl. 13:458. 1937.

*Aspidosperma quadriovulatum* Pittier, in Bol. Cient. & Tecn. Mus. Com. Venez. 1:66. 1925 = *RAUWOLFIA* sp.

- Aspidosperma quebracho-colorado* Schlecht. in Bot. Zeit. 19:137. 1861 = SCHINOPSIS QUEBRACHO-COLORADO (Schlecht.) Bark. & Meyer, in Bol. Soc. Arg. Bot. 3:156. 1950.
- Aspidosperma sessilis* Huber, in Bull. Soc. Bot. Genève, II, 6:200, fig. 13. 1915 = MICROPLUMERIA ANOMALA (Muell. Arg.) Mgf. in Notizbl. 13:458. 1937.
- Aspidosperma tuberculatum* (Vahl) R. Ben. ex Pichon, in Bull. Mus. Nat. Hist. Nat. II, 19:369. 1947 = OCHROSIA TUBERCULATA (Vahl) M. Pichon, loc. cit. 1947.

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*Italicized numerals refer to collectors' numbers, s. n. (sine numero) to unnumbered collections; parenthetical numerals refer to the numerals of the species conserved in this revision.*

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## PLATE 1

Anatomy of the corolla in *Aspidosperma* (all figures  $\times 115$ )

- Fig. 1. *A. macrocarpon* Mart.: Origin of fissure at the insertion of the filament.  
Fig. 2. *A. macrocarpon* Mart.: Fissure at level of anther.  
Fig. 3. *A. Steinbachii* Mgf.  
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Fig. 6. *A. Schultesii* Woodson.  
Fig. 7. *A. polyneuron* Muell. Arg.  
Fig. 8. *Diplorhynchus condylocarpon* (Muell. Arg.) M. Pichon: Absence of fissures.



WOODSON—STUDIES IN THE APOCYNACEAE. VIII





